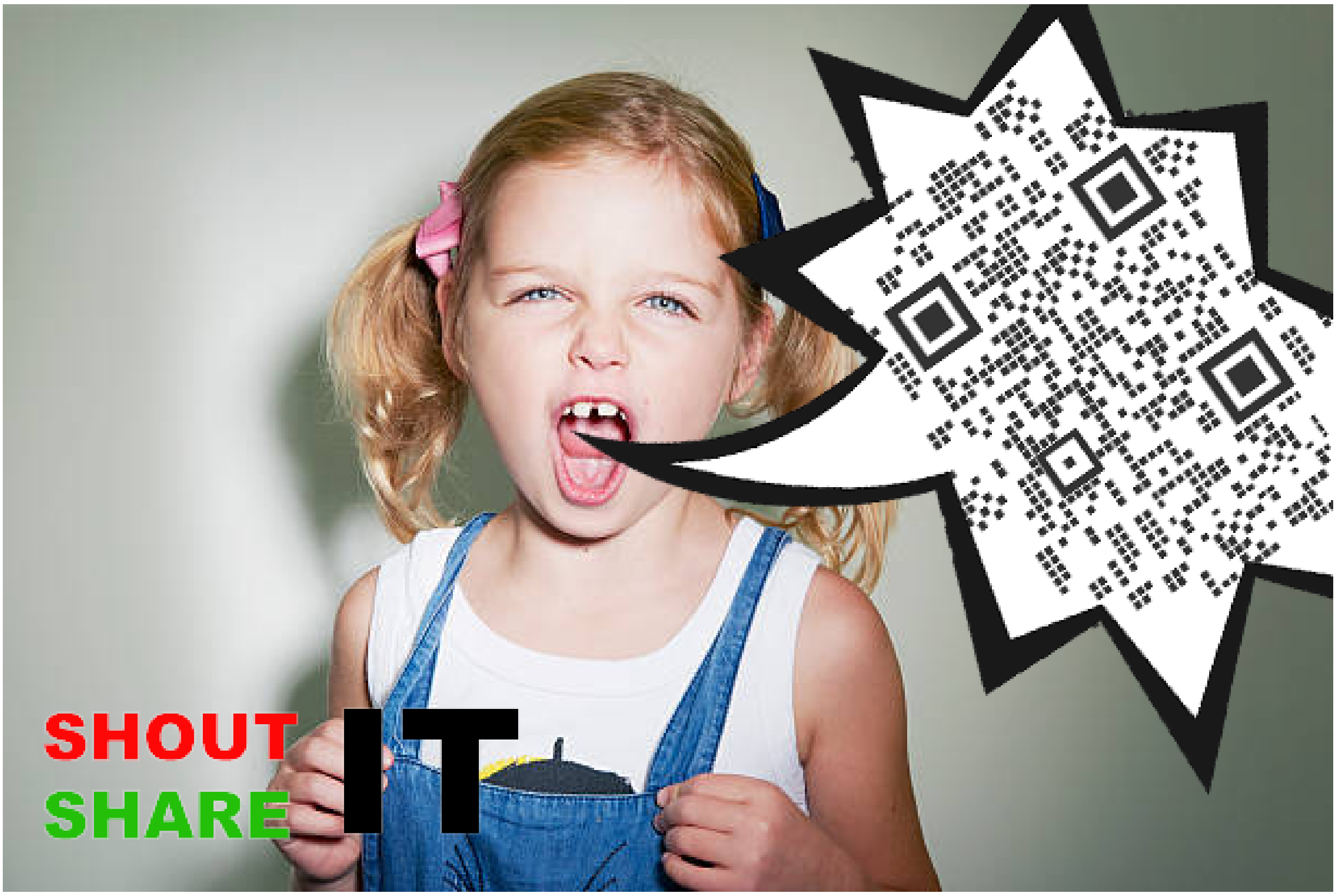
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ERRATA

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Page 814, line 28, for ‘ shall ’ read ‘ should ’.

,, ,, ,, 38, for ‘ more difficult paths for miles etc.’ read ‘ many difficult paths for mules etc.’.

,, 915, ,, 5, from bottom (reference) for ‘ Zosterops palpebrosa *alii* ’ read ‘ *Zosterops palpebrosa salimalii.*’

,, 990, ,, 3, from bottom of the page the words ‘ for stuff ’ should read ‘ poor stuff ’.

,, 1006, first three lines of last para. ‘ I have never adopted the habit of some Shikaris of combing the ground thoroughly up and down several times, no matter how tempting the field or oozy the patch ’ should read—

‘ I have never adopted the pernicious habit of some shikaris, of combing the ground thoroughly up and down several times till all the birds have flown away, for this will reduce their number to the feeding ground very materially, no matter how tempting the field or oozy the patch.’

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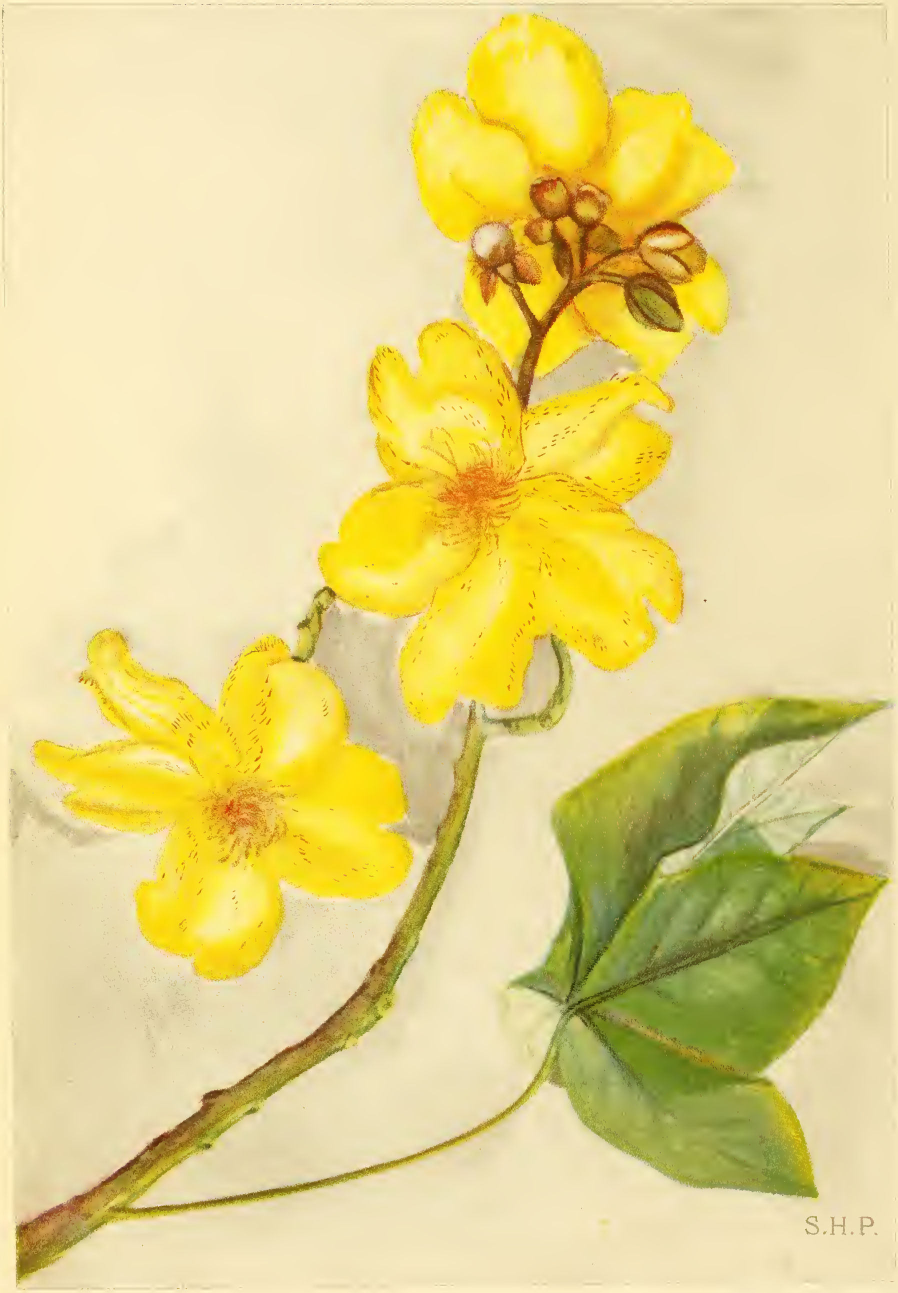

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THE YELLOW SILK-COTTON TREE.
Cochlospermum Gossypium, DC.
(½ nat. size)

Note.—

GAME BIRDS OF INDIA.

Mr. Stuart Baker's serial on Indian Semi-Sporting Birds was not received in time for publication in this issue. It will be continued in the next Number.—Eds.

JOURNAL
OF THE
Bombay Natural History Society.

August, 1933. Vol. XXXVI. No. 3.

SOME BEAUTIFUL INDIAN TREES

BY

E. Blatter, s.j., ph.d., f.l.s., and W. S. Millard, f.z.s.

Part XII.

(*With one coloured and one black and white plate and 2 diagrams.*)

(*Continued from page 355 of this volume.*)

Yellow Silk-Cotton Tree.

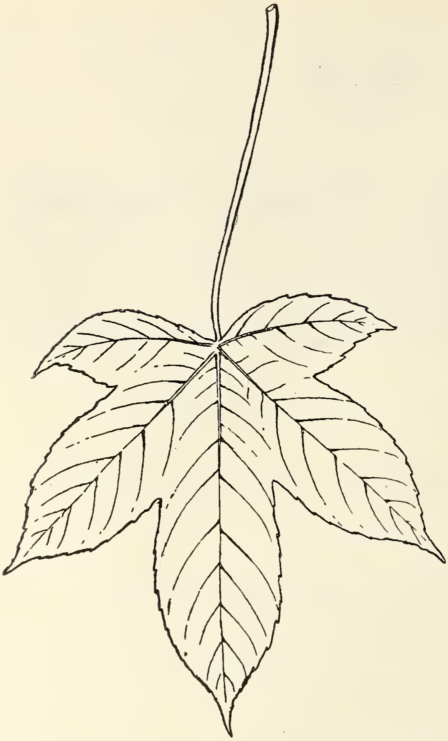
Popular Names:—Kumbi, Gabdi, Ganiar, Galgal, Gangal (Hind.); Hopo (Santali); Gulgal (Kol.); Gangam (Gond); Kontopalas (Uriya); Kumbi (Pb.); Gajra, Kumbi (N.W.P.); Gungu, Kong, Gondu-gogu (Tel.); Tanaku, Kongillam (Tam.); Betta tovare, Arisina Burga (Kan.); Chima-punji (Mal.); Ganeri (Bhil); Ganeri, Gunglay, Kathalya gonda (Mar.); Katira-i-Hindi (Pers. and Hind.).

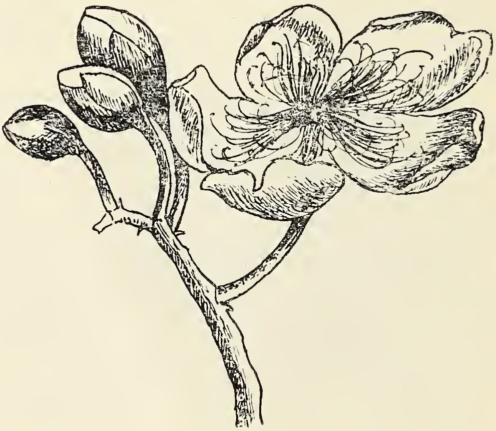
For the Gum: Nat-ka-katera, Nat-ka-katera-gond (Dec.); Hindi-katera (Hind.); Tanaku-pishin (Tam.); Konda-gogu-banka, Konda-gogu-pisunu (Tel.); Shima-pangi-pasha (Mal.).

For the Cotton:—Pili-kapas-ki-rui. Katere-ke-jhar-ki-rui (Dec.); Tanaku-parutti (Tam.); Konda-gogu-patti (Tel.); Shima-pangi-parutti (Mal.).

Cochlospermum Gossypium DC. Prodr. I (1824) 527.—*Maximilianea Gossypium* O. Kuntze. (Order *Cochlospermaceae*). (From the Greek *Kochlos*, a shell, snail, therefore anything spirally twisted; *sperma*, a seed. *Gossypium*, cotton, in allusion to the silky wool in which the seeds are embedded).

Description.—The Yellow Silk-Cotton Tree is usually a small or medium size tree, averaging from 8 to 18 feet in height. Its erect trunk, sometimes thicker than a man's body, and covered with smooth ash-coloured bark, supports a heavy crown of numerous branches. The young branches are covered with a soft fine down and marked with great scars of the fallen leaves. The leaves are scattered about the ends of the branches. They are smooth and bright green above and grey below, from a covering of whitish down. The leaf is borne on a long thick stalk; it measures from 3 to 8 inches across the blade and may have from 3 to 5 pointed lobes. The buds appear in small clusters at the end of the branches. Their much contorted, close-packed petals are cupped in a calyx composed of 5 silky, overlapping sepals, which are shed when the buds open. The leafless branches are then decked in a glory of large golden yellow flowers. They stand out against the dark boughs and provide a brilliant note of fresh colour to the bare stony hill sides where these trees mainly flourish. The flower has 5 bluntly-oval, spreading petals with deeply cleft or irregular margins. The stamens are free and numerous, forming with their long red-gold anthers a dense cluster in the centre of the bloom. The dark brown pod is almost as large as a goose's egg. It measures about 2-3 inches in diameter, has 5 lobes and contains numerous kidney-shaped seeds embedded in soft silky wool.





Leaf-shedding, Flowering and Fruiting: The leaves are shed during the cold season. The flowers appear about the beginning of the hot season at which time the tree is destitute of leaves, but they soon succeed the flowers. The fruit ripens in May and June, the seeds being carried long distances by the strong winds which are often prevalent before or at the beginning of the rains.

Yellow Silk Cotton Tree (*Cochlospermum Gossypium*).

Photos by Mrs. G. Cron.

Flowers of the Yellow Silk Cotton Tree (*C. Gossypium*).

Distribution: Western sub-Himalayas tract from the Sutlej eastwards up to 3,000 ft., Chota Nagpur, Bundelkhand, the drier parts of the Indian Peninsula, and the dry region of Burma. Characteristic of dry hilly country, occupying the hottest and stoniest slopes. —Often planted in gardens and near temples. The tree does not occur near Bombay, though quite common in the Khandesh Satpuras and in the hills about Belgaum. It thrives well in gardens and is quick growing.

Uses: The wood immersed in water for about 8 hours and the water strained off, mixed with flour and fried, forms a nutritious food in Sambalpur district. The wood is also used for torches. The gum is known as Hog gum and the silk-cotton from the seed is one of those known as Kapok. The leaves are used for the curious rude leaf-bellows with which the natives of the hills near the Assam valley smelt iron. The bark abounds in transparent gum, of which the white ants seem fond, for they kill many trees. This is the gum *katira* of the N. W. Provinces of India, and is substituted for Tragacanth. Wood soft, and only used as firewood. The cotton of its pods is used for stuffing pillows. The seeds possess a short but very soft and elastic floss from which fact the plant has received its specific name. This floss is much too short to be of any service as a textile fibre, but, with the flosses of *Bombax malabaricum*, *Eriodendron anfractuosum*, and *Calotropis gigantea*, it has been classed as a 'silk cotton.' By some writers these have recently been designated 'kapok fibres,' but there is every reason to believe that the true kapok of the Dutch upholsterers is the floss of *Eriodendron anfractuosum*. In some parts of India the floss of this tree is collected and used for stuffing pillows, for which purpose it would seem better suited than the floss from *Bombax malabaricum*, as it is not so liable to get matted. It might be found serviceable as a gun-cotton.

Medicinal Uses: The gum has the properties in a mild degree of Tragacanth, for which it is proposed as a substitute. It is also used as a mild demulcent in coughs. The floss has been recommended as admirably suited for padding bandages, splints, etc., being soft and cool. On this account it has been suggested as suitable for pillows and cushions used in hospitals, etc. The dried leaves and flowers are used as stimulants.

(To be continued).

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. BLATTER, S.J., Ph.D., F.L.S.

PART XXI.

(*With 2 plates*).

(*Continued from page 320 of this volume.*)

ASCLEPIADACEAE.

BY

E. BLATTER, S.J., Ph.D., F.L.S., & C. McCANN, F.L.S.

ASCLEPIADACEAE, (Cke. ii, 144).

Genera 300. Species 1,700.—Mostly tropical, chiefly Africa, a few in temperate regions.

Cooke gives 25 genera. We have added *Cryptostegia*, *Asclepias* and *Orthanthera; Daemia* has been changed into *Pergularia,* and *Pergularia* into *Telosma.*

1. HEMIDESMUS R. Br.

Species 1.—India.

1. **Hemidesmus indicus** R. Br. in Mem. Wern. Soc. 1 (1811) 57; Grah. Cat. Bomb. Pl. (1839) 122; Dalz. & Gibs. Bomb. Fl. (1861) 147; Wight Ic. t. 594; Cke. ii, 146.—*Asclepias pseudo-sarsa* Roxb. Hort. Beng. (1814) 20; Fl. Ind. ii (1832) 39 (*excl. syn.*).—Rheede Hort. Mal. x, t. 34.

Description: Cke. ii, 146.

Locality: *Khandesh*: W. Khandesh (Blatter & Hallberg !).—*Konkan*: Common in Salsette (McCann !); Bombay Island (Blatter !).—*W. Ghats*: Khandala (Blatter !); Pasarni Ghat (Blatter & Hallberg B1630 !); Purandhar (Blatter & McCann !).—*Deccan*: Poona (Blatter !).—*S. M. Country*: Belgaum (Ritchie); Castle Rock (Bhiva !).—Very common throughout the Presidency, especially in hedges.

Distribution: Waziristan, N. India from Banda to Oudh, Sikkim, southwards to Travancore and Ceylon.

2. CRYPTOLEPIS R. Br.

Species 20.—Palaeotropics.

1. **Cryptolepis Buchanani** Roem. & Schult. Syst. iv (1819) 409; Dalz. & Gibs. Bomb. Fl. (1861) 148; Wight Ic. t. 494; Talbot For. Fl. Bomb. ii (1911) 236; Cke. ii, 147.—*C. reticulata* Wall. Cat. 1640; Royle Ill. 270.—*Nerium reticulatum* Roxb. Hort. Beng. (1814) 19, Fl. Ind. ii (1832) 8.—*Echites reticulata* Roth. Nov. Sp. (1821) 134.—Rheede Hort. Mal. ix, t. 11.

Description: Cke. ii, 148.

Locality: *Konkan*: Elephanta (Dalzell & Gibson); Karanja (Blatter !).—*W. Ghats*: Khandala (Blatter !); Panchgani (Hallberg !).—*Deccan*: Near Poona (Bhiva).—*S. M. Country*: Belgaum (Cooke !).—*N. Kanara*: (Kanara !).

Flowers: At the beginning of and during the rains. According to Talbot throughout the year.

Distribution: Throughout India, Ceylon, Burma, China.

3. CRYPTOSTEGIA R. Br.

Lofty climbers. Leaves opposite. Flowers large, in terminal 3-chotomous cymes. Sepals lanceolate. Corolla funnel-shaped, tube short, throat campanulate; lobes broad, overlapping and twisted to the right. Coronal scales at the base of the throat, subulate, entire or 2-cleft. Filaments short; anthers adnate to the stigma, acute; pollen-masses in pairs in each cell, granular, appendages subspathulate. Stigma convex. Follicles thick, divaricate, hard, 3-winged, furrowed between the wings. Seeds comose.

Species 2.—Tropical Africa, Madagascar.

The following species has been introduced into India and is found as an escape in many parts.

1. **Cryptostegia grandiflora** R. Br. in Bot. Reg. (1819) t. 435; Wight Ic. t. 832 and Ill. ii, t. 182, f. 9; Bull. 104 Dept. Agric. Bombay p. 7.

Description: A large evergreen glabrous woody climber, stems up to 15 cm. diam., bark grey, juice copious milky. Leaves opposite, 5-10 by 3.8-5 cm., elliptic, usually abruptly narrowed at both ends, coriaceous, glossy above green beneath, lateral nerves numerous slender arched; petiole 7.5-13 mm. long, the bases of opposite pairs of petioles joined by a slightly raised line. Flowers about 5 cm. across, pinkish purple, in terminal di- or trichotomous, few-flowered cymes. Peduncle and pedicels stout, hoary or glabrous; bracts caducous. Calyx glabrous or hoary, cleft nearly to the base, lobes ovate-lanceolate, acute, with numerous glands at the base. Corolla funnel-shaped over 5 cm. long, shortly tubular below, throat campanulate; lobes broad, acute, overlapping to the right in bud, glabrous. Corona of 5 scales inserted at the base of the throat, each scale cleft into two, long, subulate segments. Stamens with short filaments, anthers adnate to the stigma, connectives produced into acute processes connivent over the stigma; pollen-masses granular, in pairs in each cell. Ovary half-inferior; stigma convex. Follicles 10-12.5 cm. long by 2.5 cm. broad near the base, woody, angled or winged, divaricate. Seeds 7.5 mm. long, oblong, compressed; coma 3.8 cm. long. (Ex Parker.)

Locality: Grown extensively in gardens in the Bombay Presidency. Also found as an escape.

Distribution: A native of Madagascar. Naturalized in many parts of India.

Uses: See Troup, *Silvicult. of Ind. Trees* ii, 673.

4. PERIPLOCA Tourn. ex Linn.

Species 12.—Temperate regions of Old World, tropical Africa.

1. **Periploca aphylla** Decne. in Jacquem. Voy. Bot. (1844) 109, t. 116; Cke. ii, 148.

Locality: *Sind*: Tatta (Blatter & McCann D337 ! D539 !); Soorjana hill, 1,800 ft. (Ticehurst 30874 !); Thano-Bula-Khan (Woodrow).

Distribution: Punjab, Sind, Baluchistan, Waziristan.—Afghanistan, Persia, Arabia, Egypt.

5. TOXOCARPUS Wight & Arn. (Cke. ii, 148).

Species 22.—Palaeotropics.

1. **Toxocarpus Kleinii** Wight & Arn. in Wight Contrib. (1834) 61; Wight Ic. t. 886.—*T. concanensis* Hook. f. F.B.I. iv (1883) 14.

We have united *T. concanensis* with *T. Kleinii.* Cooke ii, 149 says that except in the size of the leaves, T. *concanensis* does not seem to differ from *T. Kleinii.* Everybody knows how variable the leaves are in the *Asclepiadaceae.* Gamble does not mention the species in his Flora of Madras (p. 830).

Locality: Only found in the Konkan.

Distribution: Konkan of the Bombay Pres. Bababudan hills of Mysore. Kanara is very doubtful.

6. GENIANTHUS Hook. f. (Cke. ii, 149).

Species 4.—Indo-Malaya.

1. **Genianthus laurifolius** Hook. f. F.B.I. iv (1883) 16.—*Toxocarpus laurifolius* Wight Contrib. 61, Ic. t. 598.—*Asclepias laurifolia* Roxb. Fl. Ind. ii (1832) 49.

Locality: *Konkan* and *N. Kanara.*

Distribution: Sikkim Himalaya in hot valleys, Chittagong to Pegu, S. Kanara.

7. GLOSSONEMA Decne. (Cke. ii, 150).

Species 6.—Tropical Africa and Asia.

1. **Glossonema varians** Benth. in Benth. & Hook. f. Gen. Pl. ii (1876) 748; Cke. ii, 150.—*Mastostigma varians* Stocks in Hook. Ic. Pl. 9 (1852) t. 863.

Description: Cke. l.c.

Locality: *Sind*: Jemadar ka Landa, near Karachi (Stocks 467); stony ground, Karachi (Stocks 64).

Distribution: Sind, Waziristan, W. Rajputana.—Baluchistan, Persia.

8. CALOTROPIS R. Br. (Cke. ii, 151).

Species 3.—Tropical Asia and Africa.

See: Berteau, A.—Les Calotropis. L'Agric. prat. des pays chauds xii, S. 1, p. 102-109, 224-234, 324-333, 417-428, 467-475: S. 2, p. 63-73, 133-143 (1912). These articles give all the information about our 2 species, botanical, geographical and economical.

1. **Calotropis gigantea** R. Br. in Ait. Hort. Kew ed. 2, ii (1811) 78; Cke. ii, 151.

Description: Cke. l.c.

Locality: *Gujarat*: (Sedgwick !); Ahmedabad (McCann !); along B. B. & C. I. Ry. throughout (McCann !).—*Konkan*: Bombay Island (McCann !); Salsette (McCann !); Uran (Blatter !); Pen (McCann !).—*W. Ghats*: Khandala (Blatter & McCann !); Lonavla (McCann !); Panchgani (Blatter !).—*Deccan*: Poona (Blatter !), along road from Poona to Wai (McCann !).—*S. M. Country*: Belgaum Dist. (Talbot), along M. & S. M. Ry. (McCann !).—*N. Kanara*: Kala Nuddi (Ritchie 424).—A common weed in waste places.

Distribution: Throughout India, Ceylon, Malay Islands, S. China.

'Owing to the silky coma the seeds are carried to a considerable distance by the wind, and the plants spring up readily on open ground and waste places.' (Troup).

2. **Calotropis procera** R. Br. in Ait. Hort. Kew. ed. 2, ii (1811) 78; Wight Ic. t. 1278; Cke. ii, 152.

Description: Cke. l.c.

Locality: *Sind*: Karachi, Magho Pir (Sabnis B223 !), Clifton sands (Sabnis B807 !), Manora Island (Sabnis B828 !); Larkana (Sabnis B90 !, B481 !), Sehwan, Kalar soil (Sabnis B589 !), Laki hill (Sabnis B13 !, B128 !); Khairpur, Mirva canal banks (Sabnis B270 !); Nawabshah, Pad Idan (Sabnis B505 !); Hyderabad, Phuleli canal banks (Sabnis B202 !), Ganja hills (Sabnis B1005 !); Thar and Parkar, Nasarpur (Sabnis B1123 !), Jamesabad (Sabnis B969 ! B1102 !), Sanghar (Sabnis B626 !), Umarkot, sandy plains (Sabnis B1089 !); Mirpur Sakro (Blatter & McCann !).—*Cutch*: Very common (Blatter !).—*Kathiawar*: Common (Blatter !).—*Gujarat*: Abundant (Sedgwick).—*Khandesh*: Along Tapti (Blatter & Hallberg !).—*Deccan*: Poona (Cooke !).—*S. M. Country*: Common in the dry parts of Belgaum Dist. (Talbot).

Flowers: Throughout the year.

Distribution: More or less in warm dry places throughout India, Waziristan, Afghanistan, Arabia, Egypt, tropical Africa.

'Springs up in abundance on new sandy or gravelly alluvium in the beds of rivers and is a common forerunner of riverain forests of *Acacia catechu* and *Dalbergia sissoo*.' (Troup).

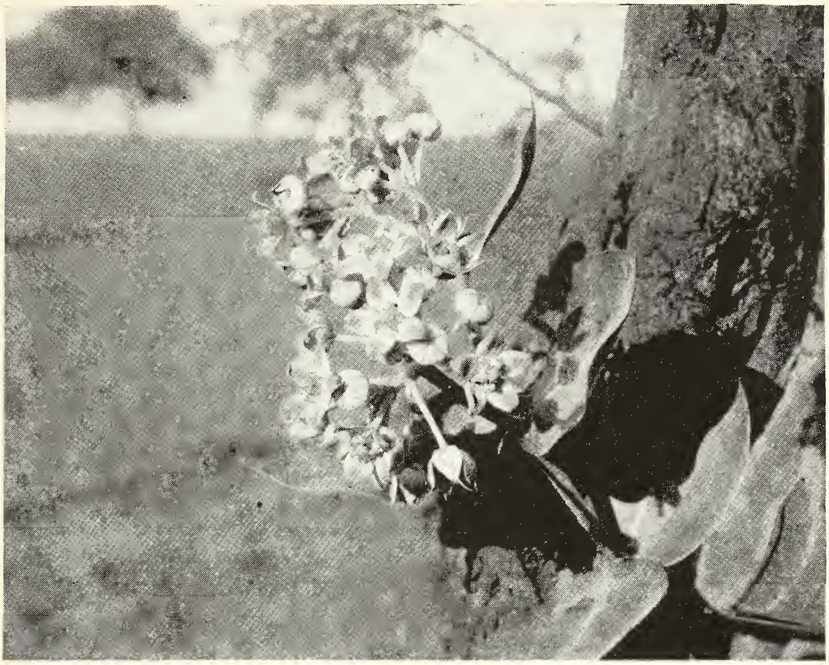
9. OXYSTELMA R. Br. (Cke. ii, 152).

Species 10.—Tropical and subtropical regions.

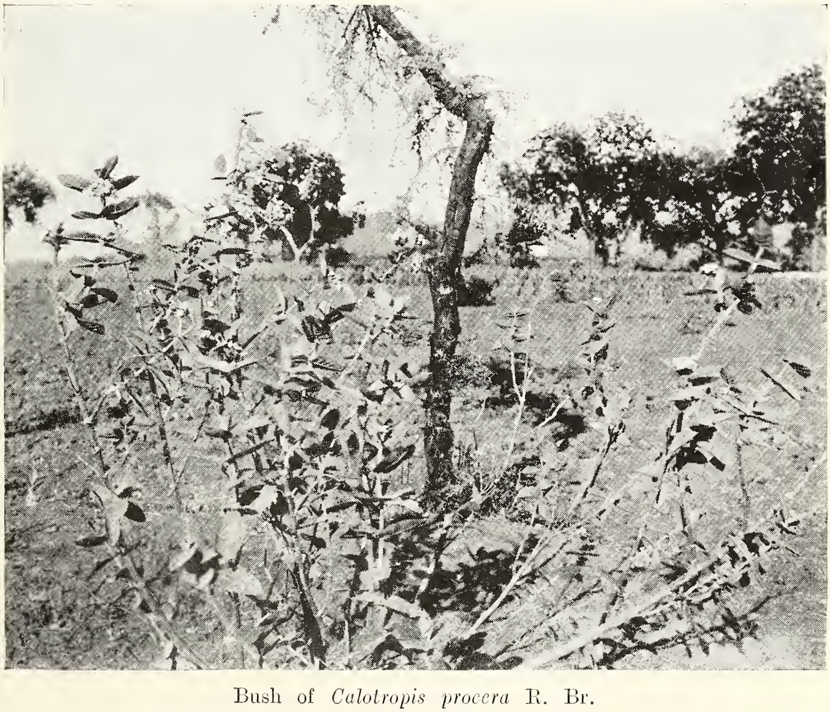
1. **Oxystelma esculentum** R. Br. in Mem. Wern. Soc. i (1811) 40; Cke. ii, 152.—*Periploca esculenta* Linn. f. Suppl. 168; Roxb. Corom. Pl. i, 13, t. 11.

Description: Cke. l.c.

Locality: *Sind*: Laki (Sabnis B64 !); Mirpur Sakro (Blatter & McCann D59 ! D63 ! D64 !); Gulam, limestone hills (Blatter & McCann D60 !), Bughar River (Blatter & McCann D58 !).—*Cutch*: (Blatter !).—*Gujarat*: Edges of stream, Watrak and Meshwa Rivers (Sedgwick !).—*Konkan*: Bombay (Hallberg !); Matunga (Hallberg !); Salsette (Hallberg !); Uran (Blatter !).—*Deccan*: Poona (Blatter !); river-bank near the Sangam (Cooke !).—*S. M. Country*: Belgaum (Ritchie).—*N. Kanara* (Law).



Flowers of *Calotropis procera* R. Br.



Bush of *Calotropis procera* R. Br.

Photos by C. McCann.

Distribution: Plains and lower hills of India, usually near water (W. Rajputana), from the Punjab to Ceylon, Assam, Pegu and Tenasserim, Ava, Java.

Var. Wallichii T. Cooke, Fl. Bomb. ii, 153.—*Oxystelma Wallichii* Wight Contrib. (1834) 54; DC. Prodr. viii (1844) 543.—We drop this variety as Cooke himself admits that in his opinion the question cannot 'be ever satisfactorily settled'. Gamble Fl. Madras 833, does not mention Wight's species.

10. ASCLEPIAS Linn.

Perennial erect herbs. Leaves opposite, alternate or whorled. Cymes umbelliform; flowers medium-sized or small. Sepals glandular within. Corolla rotate, lobes often reflexed, naked, valvate. Coronal-scales 5, erect, adnate to the column, spoon-shaped. Anther-tips membranous, inflexed; pollen-masses one in each cell, pendulous, flattened, waxy. Stigma depressed, 5-angled. Follicles turgid, beaked, smooth. Seeds comose.

Species 160.—America, Africa, especially United States.

1. **Asclepias curassavica** Linn. Sp. Pl. (1753) 215; Graham Cat. (1839) 120; Dalz. & Gibs. Bomb. Fl. Suppl. 54; Bot. Reg. t. 81.

Popular name: Bastard or Wild Ipecacuanha, Blood flower.

Description: An erect undershrub 0.9-1.2 m. high. Leaves opposite, 7.5-10 by 1.3-2.5 cm., lanceolate, thin, membranous, narrowed at both ends; petiole 5 mm. long. Flowers 7.5 mm. across, orange, in axillary umbels; peduncle 2.5 cm. long; pedicels 1.8 cm. long. Calyx 2.5 mm. long, cleft to the base, lobes oblong-lanceolate. Corolla 6 mm. long, lobes reflexed in flower, valvate in bud. Corona bright orange, of 5 erect processes adnate to the stipe of the staminal column. Staminal column distinctly stipitate, anthers with membranous inflexed tips; pollen-masses solitary in each cell, pendulous, flattened, waxy. Follicles solitary, erect, 7.5 cm. by 7.5-10 mm., straight, tapering at both ends, pericarp thin. Seed ovoid, 5 mm. long, dark brown; coma 3 cm. long.

Locality: Extensively grown in gardens, now naturalized and run wild in many places. Very abundant in the fields near the railway station at Poona; found also at Gulam (Indus Delta) in a garden (Blatter & McCann D569 !).

Distribution: A native of the West Indies, introduced into the tropics.

11. PENTATROPIS (R. Br.?) Wight & Arn.

Species 8.—Palaeotropics.

Cooke gives 2 species: *P. cynanchoides* R. Br. and *P. microphylla* Wight & Arn. The former has to cede to *P. spiralis* Decne.

1. **Pentatropis spiralis** Decne. in Ann. Sc. Nat. sér. 2, ix (1838) 327, t. 11; Boiss. Fl. Or. iv, 58; Hook. f. F.B.I. iv, 19.—*Asclepias spiralis* Forsk. Fl Aeg.—Arab. (1775) 49.—*Pentatropis cynanchoides* R. Br. in Salt Voy. Abyss. (1814) Append. 64; N. E. Brown in Dyer Fl. Trop. Afr. iv, 380; Cke. ii, 154.

The specific name *spiralis* is the oldest (1775). Besides there is some doubt as to whether the plant referred to by R. Brown is a *Pentatropis*. See Schumann in Engler and Prantl Pflanzenfamilien iv, 2, 258.

Locality: *Sind*: Larkana, Sehwan, sand dunes (Sabnis B668 !); Hyderabad, Ganja hill (Sabnis B994 !); Thar and Parkar, Mirpurkhas, watercourse (Sabnis B1029 ! B1041 !), Jamesabad, watercourse (Sabnis B973 !), Sanghar (Sabnis B624 !); Gharo (Blatter & McCann D47 ! D50 ! D51 !); Mirpur Sakro (Blatter & McCann D49 ! D52 ! D61 ! D62 !); Kulan Kote Lake (Blatter & McCann D48 !); Tatta (Blatter & McCann D17 !).

Distribution: Punjab, eastwards to the Jumna River, W. Rajputana, Baluchistan, Waziristan, Afghanistan, Arabia, tropical Africa.

2. **Pentatropis microphylla** Wight & Arn. Contrib. (1834) 52; Wight Ic. t. 352; Decne. in DC. viii, 536; Hook. f. F.B.I. iv, 20; Cke. ii, 154.—*Asclepias microphylla* Roxb. Hort. Beng. (1814) 85; Fl. Ind. ii (1832) 35.—*Cynanchum acuminatum* Thunb. Obs. in Cynanchum (1821) 5.

Description: Cke. ii, 154.

Locality: *Cutch*: Very common (Blatter).—*Gujarat*: Common on laterite plateau, Talod (Sedgwick !), less common elsewhere (Sedgwick !); Dangs

(Bhiva).—*Konkan*: Malabar Hill, Bombay (Graham).—*Deccan*: Bijapur (Bhiva). —*S. M. Country*: Gokak (Bhiva).

Distribution: Waziristan, India (Bengal, Pegu, E. & W. Peninsula, Deccan), Ceylon.

12. Pergularia L. (*non aliorum auctorum*).

Twining pubescent or tomentose undershrubs. Leaves opposite, cordate. Flowers medium-sized, greenish white, in axillary racemose or corymbose pedunculate cymes; pedicels slender. Calyx 5-partite, 5-glandular, lobes acute. Corolla-tube short, campanulate or funnel-shaped; lobes 5, ovate, spreading, overlapping to the right in bud; corona double, the outer membranous, annular, 5-lobed, the lobes truncate or dentate, the inner of 5 erect, laterally compressed, lobes spurred at the base and produced above in long free often fimbriate tips curved over the style-apex. Stamens 5, adnate to the corolla-tube; filaments connate in a column; anther-appendages membranous, inflexed; pollen-masses waxy; pendulous, attached in pairs to the shining horny pollen-carriers without caudicles. Ovary of 2 distinct carpels; styles slender; style-apex slightly convex at top. Fruit of 2 lanceolate, acuminate, smooth or softly echinate, often recurved follicles. Seeds ovate, minutely pubescent, margined, ending in a silky white coma; cotyledons suborbicular, radicle pointed.

Species 15.—Africa, tropical Asia.

According to N. E. Brown (Kew Bull. 1917, 323) the genus *Pergularia* as established by Linnaeus (Mantissa i, 8) has hitherto been misunderstood. Now it has become clear that 'Linnaeus has very accurately and unmistakably described the generic structure of the plants on which Robert Brown afterwards founded the genus *Doemia* (usually but incorrectly written *Daemia*).'

For this reason the species given by Cke. ii, 155 as '*Daemia extensa*' must be transferred to *Pergularia* and as the specific name *daemia* by Forskal is older, the plant must be called *Pergularia Daemia*. The same applies to '*Daemia cordata*' now *P. tomentosa* which was found by Sabnis in Sind.

1. **Pergularia Daemia** Blatter & McCann *nov. comb.*—*Asclepias Daemia* Forsk. Fl. Aeg.—Arab (1775) 51.—*Pergularia extensa* N. E. Br. in Dyer Fl. Cap. iv, i, 758; Gamble Fl. Madras 837; Haines Bot. Bih. & Or. (1922) 552.—*Doemia extensa* R. Br. in Mem. Wern. Soc. i (1811) 50; Wight Contrib. (1834) 59; Ic. t. 596; Hook. f. F.B.I. iv, 21; Cke. ii, 155, Parker For. Fl. Punjab (1918) 342.—*Cynanchum extensum* Ait. Hort. Kew, ed. 1 (1789) 85; Jacq. Ic. Rar. t. 54.—*C. cordifolium* Retz. Obs. (1781) 15.—*C. echinatum* Thumb. in Cynanch. (1821) 8.—*Asclepias echinata* Roxb. Hort. Beng. (1814) 20.—*Raphistemma ciliatum* Hook. f. in Bot. Mag. t. 5704.—*Daemia Forskalii* Schult. Syst. vi, 113.

Description: Cke. ii, 155.

Locality: *Sind*: Gholam (Blatter & McCann D57 !), limestone hill (Blatter & McCann D56 ! D568 !); Tatta (Blatter & McCann D54 ! D55 !); Tatta Tombs (Blatter & McCann D53 !).—*Cutch*: Very common (Blatter !).—*Gujarat*: Common in hedges (Sedgwick); Palanpur State (McCann !).—*Khandesh*: Along Tapti River (Blatter & Hallberg !).—*Konkan*: Bombay, common (Hallberg !).—*Deccan*: Surwal (McCann !); Poona (Woodrow !); Wai (McCann !).—*S. M. Country*: Belgaum (Ritchie); Dharwar (McCann !).

Distribution: Throughout India in the drier regions, Rajputana, Ceylon.—Afghanistan, Arabia, tropical and S. Africa, Madagascar.

2. **Pergularia tomentosa** Linn. Mant. (1777) 53; Desf. Fl. Atl. 1, 209; Lam. Ill. t. 176.—*Daemia tomentosa* (Linn.) Vatke in Oester. Bot. Zeitschr. (1876) 146.—*D. tomentosa* Pomel Nouv. Mat. Fl. Atl. 82; Muschler Verh. Bot. Ver. Prov. Brandb. xlix (1907) 114.—*D. cordata* R. Br. in Mem. Wern. Soc. Edinb. i, 50; Boiss. Fl. Or. iv, 59—*Asclepias cordata* Forsk. Fl. Aeg.-Arab. (1775) 49.—*Daemia incana* Decne. in Ann. Sc. Nat. 2, sér. ix, 336.

Description: Stems shortly tomentose, with or without a mixture of long hairs, sometimes slightly hispid. Leaves deflexed; petiole 4-6 mm. long; blade 1-2.25 cm. long, 10 mm. to 2.5-3 cm. broad, cordate-orbicular or cordate-ovate, apiculate or shortly cuspidate, rather thick, tomentose on both sides. Flowers in a corymb-like raceme, which (including the peduncle) is 2-5 cm. long, tomentose or shortly and softly hairy, as are also the 0.8-2.5 cm. long pedicels, and the 2-5 mm. long ovate acute sepals. Corolla-tube 2.5-5 mm.

long; lobes 6-6.5 mm. long, oblong-ovate, acute, bearded along the margins. Outer coronal-lobes 1 mm. long, subquadrate or oblong, obtuse, truncate or denticulate; inner coronal-lobes 5.5-8 mm. long, fleshy, white, lanceolate, attenuate into subulate entire or bifid points, rising much above the staminal column and incurved over it, and with an acute spur about 2 mm. long, arising below the middle (1-1.75 mm. above the base) of the staminal column. Follicles 2.5-5.5 cm. long, ovoid, acuminate into a beak, more or less echinate, sometimes nearly smooth, minutely tomentose. Seeds 8 mm. long, 5 mm. broad, nearly flat, ovate, margined, minutely tomentose on both sides.

Locality: *Sind*: Laki hill (Sabnis B242 ! B282 !, Ticehurst 28219 ! St. X. C.).

Distribution: N. Africa, Nubia, Egypt, Arabia, Syria, Persia, Baluchistan.

13. Holostemma R. Br. (Cke. ii, 156).

Species 3.—Indo-Malaya, China.

Cooke has one species: *H. Rheedianum* Spreng. which has to be changed into *H. annulare* K. Schum. *H. Rheedianum* Spreng. is an erect plant with oblong cuspidate strongly nerved leaves, and therefore very different from *H. Rheedei* Wall. But this name cannot be retained as *Asclepias annularis* Roxb. is older.

1. **Holostemma annulare** K. Schum. in Engl. & Prantl Nat. Pflanzenf. iv, 2 (1895) 250; Gamble Fl. Madras 834.—*H. Rheedei* Wall. Cat. (1828) 4469; Wight Contrib. 55, Ic. t. 597 (*corona non recte depicta tamquam surgens e corolla*).—*Asclepias annularis* Roxb. Hort. Beng. (1814) 20; Fl. Ind. ii (1832) 37.—*Sarcostemma annulare* Roth Nov. Sp. (1821) 178.—Rheede Hort. Mal. ix, t. 7.—*Holostemma Rheedianum* Cke. ii, 156 (*non* Spreng.).

Description: Cke. ii, 156.

Locality: *Konkan*: Sion (Blatter !); Malabar Hill (Blatter !); Salsette (Blatter !); Neral (Bhiva).—*Deccan*: Kothrud near Poona (Kanitkar); Bowdhan (Cooke).—*N. Kanara*: In moist forests (*ex* Talbot).

Distribution: Tropical Himalaya, Pegu, Burma, W. Peninsula, Ceylon, China.

14. Cynanchum Linn. (Cke. ii, 157).

Species 120.—Tropical and temperate regions.

Cooke gives 2 species: *C. Callialata* and *C. pauciflorum*. The latter has to be changed into *C. tunicatum*.

1. **Cynanchum Callialata** Ham. in Wight Contrib. (1834) 56; Wight Ic. t. 1279.

Locality: Add: *W. Ghats*: Lonavla (Blatter !).

2. **Cynanchum tunicatum** (Retz.) Alston in Kew Bull. (1932) 60.— *Periploca tunicata* Retz. Obs. ii (1781) 15.—*Asclepias tunicata* Roxb. Hort. Beng. (1814) 20; Fl. Ind. ii (1832) 35.—*Cynanchum pauciflorum* R. Br. in Mem. Wern. (Soc. i (1811) 45; Wight Contrib. (1834) 56; Ic. t. 354; Cke. ii, 157.—*Cynoctonum pauciflorum* Decne. in DC. Prodr. viii, 528.

Description: Cke. ii, 158.

Flowers greenish tinged with pink.

Locality: Konkan (*ex* Talbot), Deccan, S. M. Country, N. Kanara.

Distribution: Carnatic, E. slopes of W. Ghats, from the Pulneys southwards, Ceylon.

15. Sarcostemma R. Br. (Cke. ii, 158).

Species 12.—Tropical and subtropical regions.

Cooke has 3 species. *Sarcostemma brevistigma* will be changed into *S. acidum*.

1. **Sarcostemma acidum** Voigt Hort. Sub. Calcutta (1845) 542.—*Asclepias acida* Roxb. Hort. Beng. (1814) 20; Fl. Ind. ii, 31.—*Sarcostemma brevistigma* Wight & Arn. in Wight Contrib. (1834) 59; Ic. t. 595; Jacq. Voy. Bot. 107, t. 113; Hook. f. F.B.I. iv, 26; Cke. ii, 158.

Description: Cke. ii, 158.

Locality: *Sind*: Umarkot, sandy plains (Sabnis B1074 !).—*Cutch*: Common in stony places (Blatter !).—*Konkan* (Stocks).—*Deccan*: In stony places (Talbot); Poona (Cooke).—*S. M. Country*: Belgaum (Ritchie 1864).
Distribution: Bengal, Burma, Deccan, Carnatic, W. Peninsula.

2. **Sarcostemma Stocksii** Hook. f. F.B.I. iv (1883) 27; Cke. ii, 159.—*S. brachystigma* (*per errorem pro brevistigma*) Hook. Ic. t. 861 (*florum umbellae axillares non recte delineatae*).
Locality: *Sind*: Gholam, limestone hill (Blatter & McCann D523 !); (Stocks 509).—*S. M. Country*: Dharwar Dist. (Talbot).
Distribution: So far endemic in the Presidency.

3. **Sarcostemma intermedium** Decne. in DC. Prodr. 8 (1844) 538; Wight Ic. t. 1281; Cke. ii, 159.—*S. viminale* Wight Contrib. 59 (*non* R. Br.).
Locality: Add: *W. Ghats*: Pasarni Ghat (Fernandez !); Katraj Ghat (McCann !); Khandala Ghat, Satara Dist. (McCann !).—*S. M. Country*: Dharwar Dist. (*ex* Talbot).
Distribution: W. Deccan, Carnatic.

16. GYMNEMA R. Br.

Species 40.—W. Africa to Australia.
Of the 3 species given by Cooke we omit *Gymnema pergularioides* Wight & Gard. as it does not occur in the Presidency.

1. **Gymnema sylvestre** R. Br. in Mem. Wern. Soc. 1 (1811) 33; Cke. ii, 160.
Distribution: Central and W. Peninsula from the Konkan to Travancore, throughout the Bombay Presidency in monsoon forests, common in hedges in the Dharwar district, also at Mahableshwar and Panchgani, and near the coast of Karwar, Waziristan, Bundelkhand, Saharanpur, Bihar, N. Circars, Deccan and Carnatic in dry forests, up to about 2,000 ft. in the hills. Ceylon, tropical Africa.
Medicinal uses: See K. S. Mhaskar and J. F. Caius: A study of Medicinal Plants ii Gymnema sylvestre Br. In Indian Medic. Research Mem. no. 16 (1930) 1-49.

2. **Gymnema montanum** Hook. f. F.B.I. iv (1883) 31; Cke. ii, 161.
Distribution: Konkan of the Bombay Presidency, W. Ghats, Nilgiris and Anamalais at 4,000-7,000 ft.

17. TYLOPHORA R. Br.

Species 50.—Palaeotropics.
Cooke gives 5 species. *T. tenuis* will be changed into *T. tenuissima*.

1. **Tylophora fasciculata** Ham. in Wight Contrib. (1834) 50; Hook. f. F.B.I. iv, 40; Cke. ii, 162.
Distribution: Sub-Himalayan tract of Rohilkand, N. Oudh and Gorakhpur, eastwards to the Khasia hills, N. Circars, Deccan, Carnatic, Konkan and S. M. Country of Bombay Presidency.

2. **Tylophora tenuissima** (Roxb.) Wight & Arn. in Wight Contrib. (1834) 49; Wight Ic. t. 588.—*Asclepias tenuissima* Roxb. Hort. Beng. (1814) 20; Fl. Ind. ii (1832) 41.—*Tylophora tenuis* Blume Bijdr. (1826) 1062; Decne. in DC. Prodr. viii, 608; Hook. f. F.B.I. iv, 42; Cke. ii, 162.—*T. carnosa* Wall. in Wight Contrib. (1834) 49; Wight Ic. t. 351 (*non* Dalz. & Gibs.).—*Asclepias dichotoma* Rottl. in Wallich's Cat. 8200, B.C.
Distribution: Bombay Presidency (doubtful, see Cke. ii, 163).—Madras Presidency: W. Ghats, Palni hills and hills of Tinnevelly up to 7,000 ft; W. Coast, along backwaters in Travancore, Bengal, Burma, Malay Peninsula, Ceylon, Java, Borneo.

3. **Tylophora rotundifolia** Ham. in Wight Contrib. (1834) 50; Hook f. F.B.I. iv, 43; Cke. ii, 163.
Distribution: Sub-Himalayan tracts of Rohilkhand and N. Oudh, Gorakhpur, Assam, Konkan, S. M. Country, Ganjam, Anamalais, W. Ghats at 5,000 ft. in Madras Presidency.

4. **Tylophora Dalzellii** Hook. f. F.B.I. iv (1883) 43; Cke. ii, 163.—*Tylophora carnosa* Dalz. & Gibs. Bomb. Fl. (1861) 150 (*non* Wight).
Locality: Add: *W. Ghats*: Lonavla (Blatter !).
Distribution: Konkan, W. Ghats of Bombay Presidency.—Endemic (Hook. f. mentions Malabar, but Gamble does not include it in his Fl. Madras).

5. **Tylophora asthmatica** Wight & Arn. in Wight Contrib. (1834) 51; Cke. ii, 164.

18. TELOSMA Coville.

Twining undershrubs. Leaves opposite, usually cordate, membranous. Flowers rather large, yellow or greenish, in axillary umbelliform cymes. Calyx 5-partite, minutely glandular within; lobes lanceolate. Corolla somewhat salver-shaped, the tube swollen below, sometimes constricted at the throat; lobes oblong or linear, overlapping to the right, spreading in flower; corona-processes adnate to the back of the staminal column, erect, free above and sometimes 2-lamellate. Staminal column arising from near the base of the corolla-tube; anthers with membranous tips; pollen-masses erect, waxy, attached to the pollen-carriers by short caudicles. Ovary of 2 carpels, style short; style-apex umbonate or capitate. Fruit of 2 lanceolate terete rather turgid follicular mericarps. Seeds ovate, concave, ending in a silky coma.

Cooke mentions 2 species under *Pergularia*, both of which have to be transferred to *Telosma.*

1. **Telosma pallida** (Roxb.) Craib in Kew Bull. (1911) 418; Gamble Fl. Madras 844.—*Pergularia pallida* Wight & Arn. in Wight Contrib. (1834) 42; Wight Ic. t. 585; Hook. f. F.B.I. iv, 38; Cke. ii, 164.—*Asclepias pallida* Roxb. Hort. Beng. (1814) 20; Fl. Ind. ii (1832) 48.
Description: Cke. ii, 164 (under *Pergularia*).
Distribution: Tropical Himalaya, from Murree up to 5,000 ft. eastwards to Sikkim, Central India, Bihar, Burma, N. Circars, Hyderabad, Gujarat, Deccan and S. M. Country of Bombay Presidency, Bellary, foot of Anamalais.

*2. **Telosma minor** (Andr.) Craib in Kew Bull. (1911) 418; Gamble Fl. Madras 844.—*Pergularia minor* Andr. Bot. Rep. t. 184; Hook. f. F.B.I. iv, 38; Cke. ii, 165.—*P. odoratissima* Wight Contrib. 43; Ic. t. 414.—*Asclepias odoratissima* Roxb. Hort. Beng. (1814) 20.
Distribution: A native of the Himalaya. Largely grown in gardens. Siam, Indo-China, China, Ava.

19. MARSDENIA R. Br. (Cke. ii, 165).

Species 100.—Tropical and subtropical.

Cooke l.c. has followed N. E. Brown (Dyer Fl. Trop. Afr. iv, 417) in combining the genus *Dregea* E. Mey. with *Marsdenia.* Haines did the same in his 'Central Provinces' List' but again separated *Dregea* in his 'Botany of Bihar and Orissa', because he found the two genera very distinct in his area.

We follow Cooke and retain 2 of his 3 species: *M. tenacissima* and *M. volubilis.* But his *M. lanceolata* we combine with *M. volubilis.*

See: W. Rothe, Ueber die Gattung Marsdenia R. Br. und die Stammflanze der Condurango Rinde. Engl. Bot. Jahrb. li, 354-434.

1. **Marsdenia tenacissima** Wight & Arn. in Wight Contrib. (1834) 41; Cke. ii, 165.
Distribution: E. and W. Himalaya, ascending in Kumaon to 4,500 ft., N. Oudh, Rajmahal, Chittagong, Ava, Gujarat, W. Ghats, Lower Pulneys at 3,000 ft. in Madras Presidency, Ceylon, Timor, Java.

2. **Marsdenia volubilis** T. Cooke Fl. Bomb. Pres. ii, 166; Gamble Fl. Madras 846; Craib in Kew Bull. (1911) 418.—*Dregea volubilis* Benth. *ex* Hook. f. F.B.I. iv (1883) 46.
Locality: Add: *Gujarat*: Talod, climbing over trees (Sedgwick).—*Konkan*: Salsette (McCann !).—*W. Ghats*: Panchgani (Hallberg !).
Distribution: Bengal, Assam, Konkan, W. Ghats, Deccan and S. M. Country of Bombay Presidency, Madras Presidency: All plains districts and in the hills up to 5,000 ft., in dry regions, common; Malay Peninsula, Ceylon, Java.

a. **Var. Lacuna** Hook. f. F.B.I. iv, 47.—*Hoya Lacuna* Ham. in Wall. Cat. 8169; Wight & Arn. in Wight Contrib. (1834) 39; Dcne. in Jacq. Voy. Bot. 108, t. 114; Dcne. in DC. Prodr. viii, 639; Talbot For. Fl. Bomb. ii (1911) 256,

Pubescence hoary or mealy.
Locality: More common than next variety.

b. **Var. angustifolia** Hook. f. F.B.I. iv, 47; Talbot For. Fl. Bomb. ii (1911) 256, f. 419.—*Marsdenia lanceolata* T. Cooke, Fl. Bomb. Pres. ii, 167.
A suberect velvety form.
Locality: Common near Poona and generally throughout the Deccan (Talbot).

20. COSMOSTIGMA Wight (Cke. ii, 167).

Species 1.—Indo-Malaya.

1. **Cosmostigma racemosum** Wight Contrib. (1834) 42; Hook. f. F.B.I. iv, 46; Cke. ii, 167.
Locality: *Konkan*: Salsette (Blatter !).—*N. Kanara* (Talbot).
Distribution: Sylhet, Chittagong, Konkan, N. Kanara, Deccan of the Ceded Districts of Madras Presidency, Carnatic, Kollimalai hills of Trichinopoly, W. Ghats, Nilgiris, coast of S. Travancore, Ceylon, Java.

21. HETEROSTEMMA Wight & Arn.

Species 25.—Indo-Malaya.

1. **Heterostemma Dalzellii** Hook. f. F.B.I. iv (1883) 48; Cke. ii, 168.
Locality: A very rare species. *Konkan*: Vengurla and Malvan.—*Deccan*: Poona.
Distribution: Endemic.

22. HOYA R. Br. (Cke. ii, 169).

Species 100.—Indo-Malaya, Australia.
We retain the 4 species given by Cooke.

1. **Hoya retusa** Dalzell in Kew Journ. Bot. iv (1852) 294; Cke. ii, 169.
Distribution: In the rain forests of the Konkan and N. Kanara Ghats, common near Yellapur, S. Kanara (not endemic in Bombay).

2. **Hoya Wightii** Hook. f. F.B.I. iv (1883) 59; Cke. ii, 169.
Locality: Add: *W. Ghats*: Khandala, very common (McCann !).
Distribution: Bombay Presidency: Deccan Peninsula from the Bombay Ghats to N. Kanara, on trees throughout the Konkan and N. Kanara, very common on the Supa Ghats, mostly in rain forests. Madras Presidency: W. Ghats, hills of Coimbatore, Nilgiris, Anamalais and hills of Tinnevelly, at 4,000-6,000 ft.

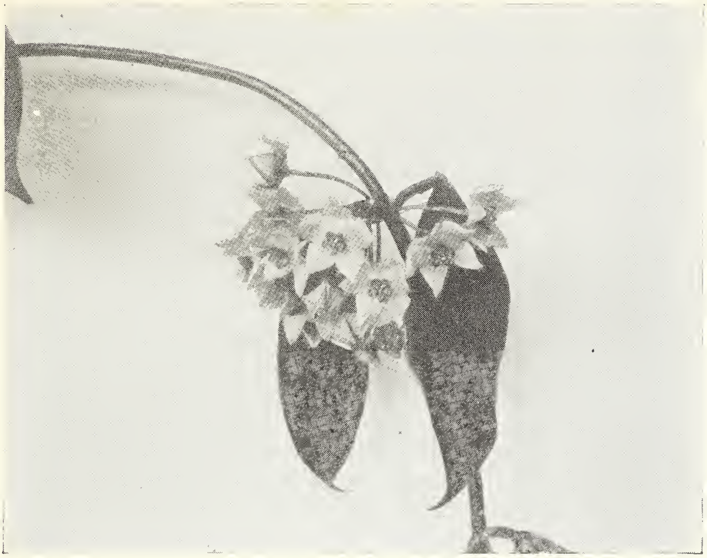
3. **Hoya ovalifolia** Wight & Arn. in Wight Contrib. (1834) 37; Cke. ii, 120.
Distribution: N. Kanara: On the Ghats near Yellapur, common in rain forests (Talbot); Madras Presidency: W. Ghats, from S. Kanara southwards, not common.
Note: According to Talbot it 'differs from *H. Wightii* by the shortly petioled, fascicled and smaller ovate leaves with flat margins, smaller flowers and a large distinct corona'.

4. **Hoya pendula** Wight Ic. t. 474 (*non* Wight & Arn. in Wight Contrib.); Cke. ii, 170; Haines Bot. Bih. & Or. 561.
Distribution: Bombay Presidency: W. Ghats, Konkan (hills of Colaba Dist.); Madras Presidency: N. Circars, Nilgiris; Bihar.
Note: *Hoya carrosa* R. Br. in Mem. Wern. Soc. 1 (1811) 27, a native of Queensland, and *Hoya Griffithii* Hook. f. F.B.I. iv (1883) 51, indigenous in the Khasia mountains are cultivated in the gardens of the Presidency.

23. OIANTHUS Benth. (Cke. ii, 171).

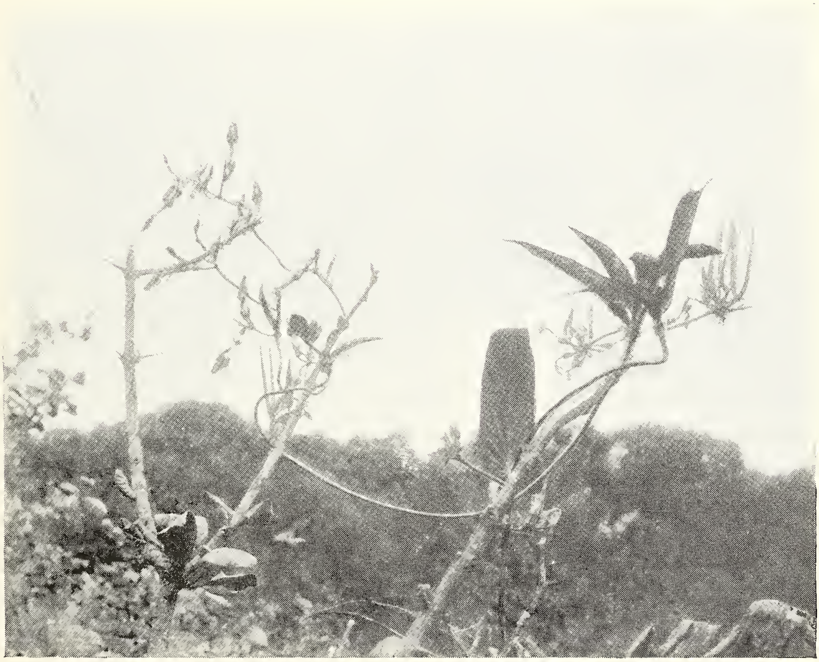
Species 4.—India.
Cooke has 2 species: *O. urceolatus* and *O. disciflorus*. We omit the latter, as there are doubts about its identity as well as its locality. But we add *O. deccanensis* Talbot.

1. Corolla urceolate; corona lobes 3-toothed at the apex 1. *O. urceolatus*.
2. Corolla tubular or ovoid-urceolate; corona lobes entire, rounded ... ... 2. *O. deccanensis*.



Flowers of *Hoya Wightii* Hook. f.

Photo by the late F. Hallberg.



Flowers and fruit of *Ceropegia polyantha* Blatt. & McC.

Photo by C. McCann.

1. **Oianthus urceolatus** Benth. in Hook. Ic. Pl. t. 1191; Cke. ii, 171.
Locality: *Konkan*: Rewadunda (*ex* Talbot).—*Deccan*: Poona (Woodrow).—*S. M. Country*: Hills near Belgaum (*ex* Talbot).—A very rare species. Endemic.

2. **Oianthus deccanensis** Talbot For. Fl. Bomb. Pres. ii (1911) 260.
Description: A twining shrub; branchlets terete, yellowish pubescent. Leaves ovate or lanceolate, 5-10 by 1.3-5 cm., acute or acuminate at the apex, rounded or cordate at the base, thinly coriaceous, scabrous above when young, glabrescent when old, pale and very sparsely pubescent particularly on the nerves beneath; petioles about 6 mm. long, sparsely pubescent. Cymes few-flowered usually sessile, interpetiolar; pedicels 2.5-5 mm. long, pubescent. Calyx divided to near the base; sepals 2.5 mm. long, oblong, obtuse with membranous margins, sparsely pubescent in the middle. Corolla thick, ovoid-urceolate or tubular, 1.3-1.6 cm. long by 3.8 mm. diam.; lobes 1.2 mm. long, triangular, valvate, with intermediate, minute teeth; corona 5-lobed; lobes broad, incurved with rounded margins.
Locality: *Deccan*: Ghats, 18 miles W. of Poona (Talbot).
Distribution: Endemic.

24. LEPTADENIA R. Br. (Cke. ii, 172).

Species 15.—Tropical Africa, Asia.
We retain the 2 species given by Cooke except that we substitute *L. pyrotechnica* for *L. spartium*.

1. **Leptadenia reticulata** Wight & Arn. in Wight Contrib. (1834) 47; Wight Ic. 350; Hook. f. F.B.I. iv, 63; Cke. ii, 172.—*Cynanchum reticulatum* Retz. Obs. ii (1781) 15.—*Leptadenia imberbe* Wight Contrib. 48.
Locality: Add: *Cutch*: Rare (Blatter !).—*Gujarat*: Abundant (Sedgwick !); Surat (*ex* Talbot).
Distribution: Punjab, Burma, Bombay Presidency, Madras Presidency: N. Circars, Deccan, Carnatic, westwards to the E. slopes of the Ghats, up to about 3,000 ft., chiefly in hedges, Ceylon, Ava.

2. **Leptadenia pyrotechnica** (Forsk.) Decne. in Ann. Sc. Nat. (1838) 269; Boiss. Fl. Or. iv, 63.—*Cynanchum pyrotechnicum* Forsk. Fl. Aeg.—Arab. (1775) 53; Del. Fl. d'Eg. 54, t. 20, f. 30.—*Sarcostemma pyrotechnicum* Roem. & Schult. Syst. vi, 116.—*Microloma pyrotechnicum* Spreng. Syst. i, 855.—*Leptadenia Spartium* Wight Contrib. (1834) 48; Hook. f. F.B.I. iv, 64; Cke. ii, 173.—*L. Jacquemontiana et gracilis* Decne. in DC. Prodr. viii (1844) 641.
Description: Cke. ii, 173 (under *L. Spartium*).
Locality: *Sind*: Larkana (Sabnis B468 !); Sehwan, Kalar soil (Sabnis B24 !), river-banks (Sabnis B582 !), sand dunes (Sabnis B667 !); Laki hill (Sabnis 83 !); Sukkur, Kalar soil (Sabnis B559 !); Khairpur, Mirva canal banks (Sabnis B268 !); Nawabshah, Pad Idan (Sabnis B567 !); Hyderabad, Ganja Hill (Sabnis B991 !); Indus banks near Kotri (Sabnis B396 !); Thar and Parkar, Nasarpur (Sabnis B1124 !); Mirpurkhas (Sabnis B1054 !); Umarkot, sand dunes (Sabnis B1011 ! B1077 !); Mirpur Sakro (Blatter & McCann D46 !); Bughar River (Blatter & McCann D45 !); Gharo (Blatter & McCann !).—*Cutch*: Very common (Blatter !).—*Kathiawar*: Abundant (Blatter !); Perim Island (Blatter !); occasional near Ahmedabad, locally common in sand and in other places (Sedgwick !); Palanpur (McCann !).
Distribution: Punjab, W. Rajputana, Waziristan, Baluchistan, Sind to Gujarat, Arabia, Egypt, tropical Africa.

25. ORTHANTHERA Wight (not in Cke.).

An erect virgate leafless shrub. Flowers small, crowded in dense peduncled woolly cymes. Calyx-lobes lanceolate, eglandular. Corolla salver-shaped; tube ovoid, equalling the lanceolate valvate lobes. Corona of 5 small erect scales inserted in the sinuses of the corolla-lobes, sometimes with an inconspicuous fleshy ring below the anthers. Staminal column ovoid, anther-tips without appendages, pollen-masses globose, stipitate, erect. Stigma included, flat, 5-gonal. Follicles elongate, cylindric, opening out flat after dehiscence. Seeds comose.
Species 4.—Africa, India.

1. **Orthanthera viminea** Wight & Arn. in Wight Contrib. (1834) 48; Royle Ill. 274, t. 66, f. 1; Decne. Jacq. Bot. Voy. 109, t. 115; Hook. f. F.B.I. iv, 64; Duthie Fl. Upper Gang. Pl. ii, 65.

Description: A small erect leafless shrub with stiff glabrous branches about as thick as a crow's quill. Flowers dull brown, arranged in compact woolly cymes; peduncles 0.6-2.5 cm. long, pedicles very short. Sepals linear-lanceolate, nearly as long as the corolla. Corolla salver-shaped, 4 mm. long, villous outside, tube ovoid; lobes erect, oblong, as long as the tube, keeled and glabrous within. Follicles solitary, erect, 10-15 cm. long, linear, compressed; pericarp thin, brown within. Seeds 4 mm. long, coma 13 mm. long.

Locality: *Sind* (*ex* Duthie).

Distribution: Upper Gangetic Plain, Himalaya up to 2,500 ft. from Kumaon to Peshawar, Punjab, Sind, Rajputana.

26. CEROPEGIA Linn. (Cke. ii, 174).

Species 125.—Africa, Asia, Australia.
Cooke has 8 species. We add 4 more.

I. Stem erect
  1. Leaves linear, less than 12 mm. wide ... 1. *C. attenuata.*
  2. Leaves not linear ... ...
    a. Leaves acute at the base, glabrous ... 2. *C. Lawii.*
    b. Leaves subcordate at base; glabrous-hairy above ... ... 3. *C. panchganiensis.*
II. Stems twining
  1. Calyx-segments shorter than the corolla
    a. Leaves fleshy
      † Leaves small, less than 12 mm. long or o ... ... 4. *C. juncea.*
      †† Leaves more than 12 mm. long, never wanting ... ... 5. *C. bulbosa.*
    b. Leaves membranous
      † Corolla-lobes ½ as long as the tube
        § Leaves and peduncles glabrous; corolla-lobes contracted into a narrow beak in bud ... ... 6. *C. tuberosa.*
        §§ Leaves and peduncles pubescent or hispid; corolla-lobes forming a clavate head in bud
          * Inner corona-lobes hooked ... 7. *C. hirsuta.*
          ** Inner corona-lobes straight
            ¶ Peduncles 4-8-flowered ... 8. *C. oculata.*
            ¶¶ Peduncles multi-flowered (up to 30) ... ... 9. *C. polyantha.*
      †† Corolla-lobes as long or nearly as long as the tube ... ... 10. *C. Stocksii.*
      ††† Corolla-lobes about ⅓ the tube ... 11. *C. hispida.*
  2. Calyx-segments always much longer than corolla ... ... 12. *C. fantastica.*

1. **Ceropegia attenuata** Hook. Ic. Pl. ix (1852) t. 867; Hook. f. F.B.I. iv, 67; Cke. ii, 175.

Locality: *Konkan*: Near Vengurla (Ritchie); Malvan (Dalzell); Salsette, Kanari Caves (Blatter !); Karanja Island (Blatter !).—*Deccan*: Junnar (Woodrow).

Distribution: Endemic.

2. **Ceropegia Lawii** Hook. f. F.B.I. iv (1883) 67; Cke. ii, 175.

Distribution: Endemic.

3. **Ceropegia panchganiensis** Blatter & McCann, *nov. sp.*

Asclepiadaceae. Similis C. Lawii Hook. f. a qua tamen differt foliis basi subcordatis nunquam acutis supra et marginibus bulboso-hirsutis, pedunculis 4-5-floris, pedicellis 8-15 mm. longis, corolla basi multum inflata.

Description: A coarse plant, up to 45 cm. high; root a tuber. Stem stout, hard, succulent, slightly thickened at the nodes, pale green, upper part densely pubescent, hairs with tiny bulbous bases which alone remain in the lower part of the stem and which make the stem rough. Leaves 3 in a whorl, or opposite, the lowest ovate-mucronate, the upper ovate-oblong or ovate-lanceolate, acuminate, up to 9 cm. by 5 cm., base subcordate, never acute, bulbous-hairy above and on margin, glabrous and subglaucous below, nerves and veins deeply depressed above, very prominent below; petioles up to 25 mm. long, stout, deeply channelled above, scaberulous. Flowers in pedunculate cymes; peduncles 4-5-flowered, arising from between the petioles (not more than 2 peduncles between 2 leaves, sometimes the third leaf is replaced by a peduncle) stout, strict, hairy; pedicels up to 8-15 mm. long, very hairy. Bracts linear-subulate, up to 3 mm. long, bright green, glabrous. Calyx divided to the base; sepals 3-4 mm. long, linear-lanceolate-acuminate, scabrous outside in lower half. Corolla 3-4 cm. long, tube striate, greenish white or very pale lilac outside, turning purple or dark blue on drying, much inflated at base, inflated part 8-10 by 5-6 mm., distinctly ribbed; lobes obovate-acute, incurved, forming a 5-lobed head, 5-6 mm. long, 7-9 mm. diam., flattened on top, tips united, ventral side of lobes olive green. Corolla inside: inflated part very dark purple, mottled light brown near upper constriction, narrow tube dark purple below, getting brownish about the middle, then turning bluish green just below the lobes; lobes olive green. Outer corona: cup-shaped, dark purple, 5-lobed, lobes long, bicuspidate, ciliate with long brittle stiff hairs. Inner corona-lobes erect, fleshy, yellow, with a few long stiff hairs, cylindrical, slightly thinner towards apex, 2 mm. long. Anthers oblong, yellow. Fruit not seen.

Locality: *W. Ghats*: Panchgani, compound of Bicklan, in high grass (Blatter 200 type).

Flowers: 24-7-26.

4. **Ceropegia juncea** Roxb. Corom. Pl. i (1795) 12, t. 10; Hook. f. F.B.I. iv, 68; Cke. ii, 175.

Distribution: S. M. Country, N. Kanara, N. Circars, Carnatic, S. Travancore, in dry forests.

5. **Ceropegia bulbosa** Roxb. Corom. Pl. i (1795) 11, t. 7; Hook. f. F.B.I. iv, 67; Cke. ii, 176.

Distribution: Punjab plains, Upper Gangetic plain, Sind (Agharkar), Gujarat (Sedgwick), Konkan, S. M. Country, Deccan, N. Kanara, S. Kanara and Malabar, Carnatic.

6. **Ceropegia tuberosa** Roxb. Corom. Pl. i (1795) 12, t. 9; Hook. f. F.B.I. iv, 70; Cke. ii, 176.

Distribution: Bombay Presidency: Konkan, Deccan, S. M. Country. Madras Presidency: N. Circars, Deccan and Carnatic to the lower slopes of the Ghats, up to about 3,000 ft., common.

7. **Ceropegia hirsuta** Wight & Arn. in Wight Contrib. (1834) 30; Hook. f. F.B.I. iv, 71; Cke. ii, 177.

Locality: Add: *W. Ghats*: Khandala (Blatter !); Panchgani, in grass and amongst rocks (McCann !).

Distribution: Mt. Abu, Konkan, Deccan, W. Ghats, Madras Presidency: N. Circars in Ganjam, Rampa hills of Godavari, W. Ghats, Nilgiri hills, Anamalais.

8. **Ceropegia oculata** Hook. Bot. Mag. (1844) t. 4093; Hook. f. F.B.I. iv, 72; Cke. ii, 177.

Distribution: Konkan.—Endemic in the Presidency.

9. **Ceropegia polyantha** Blatter & McCann in Journ. Bomb. Nat. Hist. Soc. xxxiv (1931) 936, with plate.

Description l.c.—When we described *C. polyantha* we had not seen the fruit. We found it on the last of October 1932 in the same locality. Here is the description: Follicles erect, parallel or divergent at a right angle, cylindric, tapering towards a blunt apex, about 10 cm. long, by 0.5 cm. where thickest, glabrous, smooth, green or greenish purple speckled with purple, tips deep purple. Seeds ovate-oblong, flattened with a broad submembranous margin, 6.5 by 4 mm., coma about 3.5 cm. long.

Locality: *W. Ghats*: Lingmala hills near Mahableshwar (McCann &

Fernandez 3470 A, B, C, D ! type, 3441 ! 3442 ! 3471-78 !); Khandala, on top of 'Sausages' (Blatter ! Herb. St. X. C.).

Flowers: Septr.

10. **Ceropegia Stocksii** Hook. f. F.B.I. iv (1883) 74; Cke. ii, 178; Gamble Fl. Madras 859.

Description: Cke. l.c.—"A rather large climber with corollas green shaded with purple spots on the funnel part of the tube; follicles very slender, nearly 1 ft. long." (Gamble).

Distribution: Bombay Konkan; Madras Presidency: W. Ghats, Anamalais and hills of Travancore at 2,000-4,000 ft., in moist forests.

11. **Ceropegia hispida** Blatter & McCann in Journ. Bomb. Nat. Hist. Soc. xxxv (1931) 409, with plate.

Locality: *W. Ghats*: Panchgani, near Godauli (McCann & Fernandez 3566 !).

Flowers: October.

12. **Ceropegia fantastica** Sedgwick in Journ. Ind. Bot. ii (1921) 124.

Locality: *N. Kanara*: Sulgeri, 500 ft., rainfall 200 in. (T.R.D. Bell No. 4252 ! Herb. Sedgwick & Bell).

Flowers: Aug.

Sedgwick calls it 'a curious species, at once recognisable by the enormously long and fine calyx segments, bracts and bracteoles. The corolla is in general shape typical of the genus, the segments of the swollen apical portion meeting at their tips. The corona was quite indistinguishable in soaked-out flowers.'

27. FREREA Dalz. (Cke. ii, 178).

Species 1.—Western Peninsula of India.

1. **Frerea indica** Dalz. in Journ. Linn. Soc. viii (1865) 10, t. 3; Cke. ii, 178.

Distribution: Deccan.—Endemic in the Presidency.

28. CARALLUMA R. Br. (Cke. ii, 179).

Species 65.—Mediterranean to E. India.

See: F. H. Gravely & P. V. Mayuranatham, The Indian Species of the Genus *Caralluma*, in Bull. Madras Government Museum, new series, Nat. Hist. Sect. iv (1930) pt. 1.

Cooke has 2 species: *C. edulis* Benth. and *C. fimbriata* Wall. We follow Gravely etc. in making *C. fimbriata* a variety of *C. adscendens*. Finally we add *Boucerosia truncato-coronata* Sedgwick under the name of *C. truncato-coronata*.

I. Flowers arising in or more usually close beside the axils of the rudimentary and evanescent leaves
  1. Outer lobes of corona distinct, 10 in number, their filamentous apices widely separated throughout ... ... 1. *C. edulis.*
  2. Adjacent pairs of outer lobes of corona fused to form plates, from the distal end of each of which arises a pair of long terminal filaments, almost in contact with one another at base ... ... 2. *C. adscendens.*
    a. Angles of stem, at least towards base, rounded; stems small and of about equal thickness throughout ... ... *var. fimbriata.*
    b. Angles of stem, at least towards base, acute; stems larger, more or less strongly attenuate distally ... ... *var. attenuata.*

II. Flowers terminal, exactly umbellate ... ... 3. *C. truncato-coronata.*

1. **Caralluma edulis** Benth. Gen. Pl. ii (1876) 782; Cke. ii, 179; Gravely & Mayur. 8—*Boucerosia edulis* Edgew. in Journ. Linn. Soc. vi (1862) 205, t. 1.—*Boucerosia Stocksiana* Boiss. Fl. Or. iv (1879) 64.

Description: Cke. l.c.—Cooke has not seen the follicles. Edgeworth describes them like this: Follicles erect, terete, quite smooth and glabrous, very attenuate. Seeds marginate, winged, long comose.

Locality: *Sind*: Jamadar ka Landa (Stocks 533); Mulir, near Karachi (Woodrow).

Distribution: Punjab, Sind, Baluchistan.

2. **Caralluma adscendens** R. Br. in Mem. Wern. Soc. i, 25.—*Stapelia adscendens* Roxb. Corom. Pl. i (1795) 28, t. 30.—*Caralluma fimbriata* Wall. Pl. As. Rar. i (1830) 7, t. 8; Loddiges (1832) no. 1863, fig. Cke. ii, 179.—*C. attenuata* Wight Ic. (1850) t. 1268; Ill. t. 155b, fig. B.

Distribution: Probably occurs in suitable situations all over the Indian Peninsula south and inclusive of Poona in the west and Ganjam in the east (*ex* Gravely etc.).

Var. fimbriata Gravely & Mayur. 13.

Stems small, not definitely attenuate, sometimes reddish distally, their angles rounded; flowers rather small, more or less pendulous, hairy.

Locality: *W. Ghats*: Pasarni Ghat, about 3,500 ft. (Blatter & Fernandez !).—*Deccan*: Nira River, 2,500 ft., rocky banks (Fernandez !).

Distribution: Kambakkam, Nagari, Nagalapuram, Chingleput, Ceylon, Burma.

Var. attenuata Gravely & Mayur. 13.

Stems, except when young and undergoing rapid growth, strongly attenuate and usually much branched distally, usually with reddish streaks, their angles always rounded; total height often well over 60 cm., of which only the lower part (less than half this height) is stout; flowers hairy, less definitely pendulous than the preceding variety and often opening more widely when they are about 15 mm. across, their markings usually dark purple in colour.

Locality: *Deccan*: Bapudi, 3 miles north of Poona (Ganpat).

Cooke put this plant under *fimbriata*, but Gravely etc. says that this record 'almost certainly' refers to *attenuata*.

Distribution: See Gravely etc. 13.—The most widely distributed of all the varieties of *C. adscendens*.

3. **Caralluma truncato-coronata** Gravely & Mayur. 21.—*Bouccrosia truncato-coronata* Sedgw. in Journ. Ind. Bot. ii (1921) 125.

Sedgwick calls it an inconspicuous plant with elegant flowers and adds that it differs from the other Indian species of *Boucerosia* in having the bifid corona lobes reduced to a broadly truncate top with minute horns or teeth at each end.

(*To be continued.*)

RESPIRATION IN FISHES.

BY

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With 4 plates and 21 text-figures

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PREFATORY NOTE.

'Respiration in Fishes' was the title of my lecture given at the Indian Museum on the 9th of December, 1932, as part of the series of the Winter Course of Lectures for 1932-33. Every effort was made to treat the subject in a popular way, but at the same time the results of all up-to-date researches on the subject, as well as several new facts and inferences were embodied in it. In consequence, it was thought advisable to publish the matter so as to make it available for the university students and research workers. References to the relevant literature are given at the end with the same object in view. The lecture was illustrated with 44 lantern-slides, but it was not intended to publish a large number of figures, as owing to the serious curtailment of the staff of the Zoological Survey of India and the consequent paucity of artists in the Survey, it was not possible for me to get sufficient illustrations made for this popular article. However, after going through the article Mr. S. H. Prater, Curator of the Bombay Natural History Society, advised me to illustrate it properly so as to increase its usefulness for the general reader. On explaining to him my difficulty, he very generously persuaded the Bombay Natural History Society to make a grant towards the cost of the drawings, most of which are original delineations of specimens and dissections. I am very grateful to the Society and to Mr. S. H. Prater for this help.

The photograph showing the habitat of the peculiar fish *Gyrinocheilus* has been sent to me by Dr. H. M. Smith of the Siam Fisheries and I am indebted to him for permission to reproduce it. The text-figures 7 and 15 are taken from one of my notes in the *Current Science*, and I am thankful to the Editor, Mr. C. R. Narayan Rao, for permission to use the blocks. Similarly, the Director of the Zoological Survey of India has very kindly allowed me to use the blocks of text-figures 9, 13 and 14, which are taken from my papers in the *Records* and *Memoirs of the Indian Museum*. The text-figure 10 has already appeared in the *Journal of the Bombay Natural History Society*.

As it was not possible to refer to details of structures in a popular lecture, the deficiency has now been made up by giving fairly comprehensive descriptions* of figures.

My grateful thanks are due to Lt.-Col. R. B. S. Sewell, Director, Zoological Survey of India, for helpful suggestions and for going through the manuscript. To Babu R. Bagchi I am indebted for most of the illustrations, which he has executed with great skill and care. Mr. D. D. Mukerji has helped me in several ways for which I am thankful to him.

The specimens from which figures in plates 3 and 4 were drawn have been presented to the Bombay Natural History Society.

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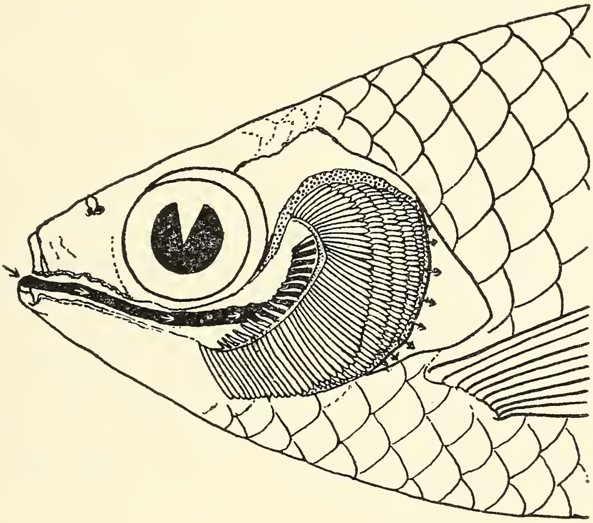
* Dr. Das's paper (16) has proved invaluable in writing up an account of the figures in plates 3 and 4.

Respiration, as we all know, is a physiological process which results in the aeration of blood. The essential feature of this process is the taking in of oxygen and giving up of impurities in the form of carbon dioxide. 'Paradoxical as it may appear, a constant supply of fresh air is as important to a fish as to ourselves, the air being required for its contained oxygen.'[1] There is, however, a great difference in the manner in which oxygen is taken in by a fish and by any higher vertebrate. The land animals breathe the atmospheric air direct, and extract the oxygen from it by means of their lungs, the fishes on the other hand by the use of special organs known as gills, make use of oxygen contained in the air dissolved in the water. This can be demonstrated very easily by placing a fish in a vessel containing water from which all air had been expelled either by the action of a pump or by intense heating. The fish will speedily show signs of suffocation and will die of asphyxiation within a very short period. This is true of most of the fishes but there are a few brilliant exceptions which will be referred to later. I have used the word *brilliant* advisedly, for these fishes have made it possible to understand the probable mode of evolution of the terrestrial vertebrates, including man. It may be mentioned in passing that all the higher vertebrates, whether amphibians, reptiles, birds or mammals, possess gill-like structures of one kind or another at some stage of their lives, thus providing a clear proof of their fish ancestry. In a human



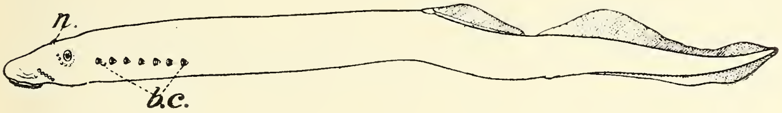
Text-fig. 1.—Dissection of the head from the side of *Barbus* (*Puntius*) *sophore* (Ham. Buch.) to show the passage of the respiratory current (indicated by arrows) and the nature and position of the gills. ×4.

embryo of about 3 to 4 weeks the sides of the throat are provided with four pairs of clefts, which not only correspond in position to the gill slits of a fish, but their supporting skeleton and associated blood vessels provide further resemblances. This fish like apparatus is, of course, never used for breathing, and as development proceeds it becomes modified out of all recognition.

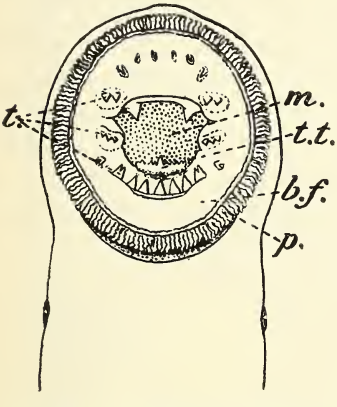
I shall not detain you over the anatomical features of the structure of a gill, but attention may specially be directed to two outstanding facts. In vertebrate animals all breathing organs, no matter what their form, are closely associated with the upper part of the food channel or alimentary canal. Secondly the function of all respiratory organs is to bring the blood in close contact with air, whether free or dissolved in water. For this purpose an extensive area is provided in which blood circulates in small vessels through extremely thin membranes. In this way the chemical properties of Haemoglobin, the red colouring matter of the blood, are brought into play, and result in the absorption of oxygen and the liberation of carbon dioxide. This evening I propose to confine my attention mainly to the mechanism of respiration in fishes, and shall show you the diversity of respiratory surfaces in this group of animals.

The normal mode of breathing in a fish consists of an inspiratory and an expiratory phase. Inspiration is brought about by the action of the coraco-mandibular, the coraco-hyoid and the coraco-branchialis muscles which are attached behind to the pectoral girdle. When they contract, they (*a*) open the mouth, (*b*) lower the floor of the mouth (basihyoid) and (*c*) drag back the branchial arches, thus causing the gill slits to be closed. Now water rushes in freely. Expiration, which follows soon after, is brought about by an opposing set of muscles, the 'lavators' of the mandibular hyoid and branchial arches. These are attached to the back of the skull and the most anterior part of the vertebral column. By their action (*a*) the mouth is closed, (*b*) the floor of the mouth is lifted, thus diminishing the size of the buccal cavity and (*c*) the branchial arches are pulled forward causing them to diverge from one another like the ribs of an umbrella, thus opening the gill sacs and allowing the water in the pharynx to escape to the exterior. These respiratory movements are no doubt responsible for the familiar phrase 'to drink like a fish.' The author of the phrase seems to have erroneously assumed that the regular opening and shutting of the mouth is a proof that the fish drinks. A fish drinks only to expel the water through the gill openings, whereas a man who 'drinks like a fish' takes the liquid in his system. There is another difference also. When deprived of a 'drink' the majority of fishes become 'queer', whereas men become 'queer' when they indulge in the habit of 'drinking like a fish.' There are, however, exceptions to this rule both among fish and men. Some fish can go 'dry' for a short period, and there are surely men who can 'drink like a fish' for sometime at least without any outward effect on their behaviour. So far as actual drinking is concerned, it is doubtful whether a fish drinks at all, for during respiration the gullet is so tightly closed behind the last pair of pharyngeal clefts that little, if any, water is able to find its way into the stomach.

Most of the fishes breathe in the manner described, but there are some which, owing to their peculiar mode of life, have been obliged to modify this process in accordance with change in their habits. The Lamprey, for example, has adopted a parasitic habit, and spends a good deal of its time attached to other fishes by means of its sucker-like mouth. It is obvious that when thus attached it would be impossible to inhale water through the mouth without losing its hold. The water then is taken in and expelled from the branchial sacs by their external openings through the alternate expansion and contraction of their muscular walls. Freshwater Lampreys use their mouths for holding on to rocks in swift waters. The habits of the related Hag-fish are still more singular, for it bores right into the fish it attacks.



Text-fig. 2.—Lateral view of the Lamprey-*Lampetra fluviatilis* (Linn.). ×1/3. *n*: median nostril; *b.c*: branchial clefts.

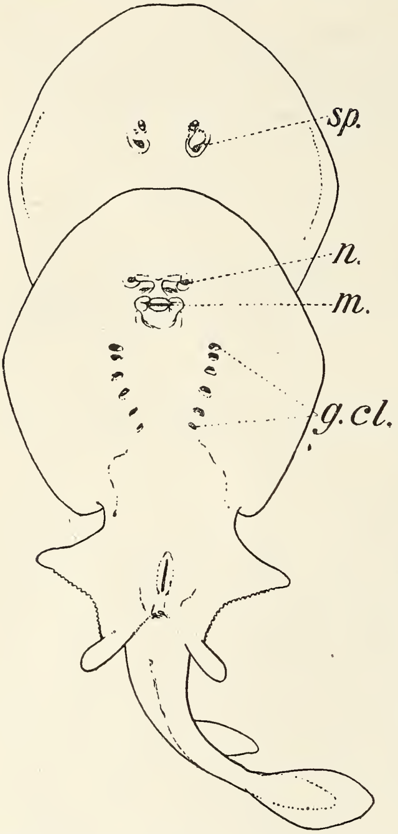


Text-fig. 3.—Ventral surface of head showing suctorial mouth of *Lampetra fluviatilis* (Linn.). ×2. *b.f.*: buccal-funnel; *m*: mouth; *p*: papillated margin of funnel; *t*: teeth of buccal-funnel; *t.t.*: teeth on tongue.

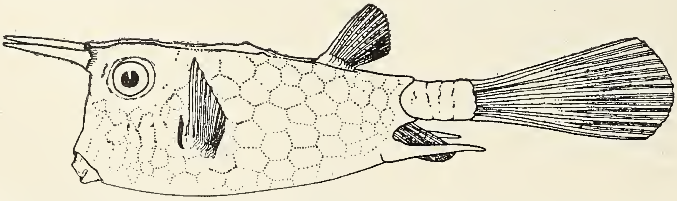
A Skate as judged from the build of its body, is essentially adapted for a life on the sea floor, and consequently its method of breathing has undergone modification. While swimming or crawling about it is able to breathe in the normal manner, but when resting at the bottom there is a grave danger of taking in sand with the stream of water and thus clogging up the delicate gill-filaments. The mouth and the external gill openings are on the under side of the head, but there is a comparatively large opening behind the eye. This special structure is known as a spiracle. The Skate when resting at the bottom inhales water by way of the spiracle and expels it through the gill openings in the normal manner. Rand[2] and Darbishire[3] have observed the spouting of water from the spiracle and concluded that in addition to this causing a respiratory incurrent through the mouth, the fish regularly employs spouting or the spiracular excurrent either 'as a means of keeping the eyes unobstructed' or 'as a means of ridding the pharynx of unpleasant matter'.

In the Trunk-fishes the head and body form a strong bony box and, therefore, the movements of any part of the body are difficult. Thus they are obliged to keep up the flow of water over the gills by a series of rapid panting movements, as many as 180 per minute. The pectoral fins of this fish are supposed to assist in respiration by fanning a current of water through the gill openings by their constant motion. Professor Goode[4] writes: 'when taken from the water one of these fishes will live for two or three hours, all the time solemnly fanning its fins, and when restored to its native element seems none the worse for its experience, except that, on account of the air absorbed, it cannot at once sink to the bottom'.

Fulton[5] has observed the reversed action of the gill covers in Plaice. When clinging to the sides of an aquarium tank with their snouts out of water the current was drawn in from behind through the gill-openings and spouted 'as a little fountain, an inch or so in height'. The advantage of such a habit is obvious, as in the circumstances the current cannot be inhaled through the mouth.



Text-fig. 4.—Dorsal surface of head and ventral view of a young specimen of the Skate, *Narcine timlei* (Schn.) Nat. size.
g. cl.: external gill-clefts; *m*: mouth; *n*: nostril; *sp*: spiracle.

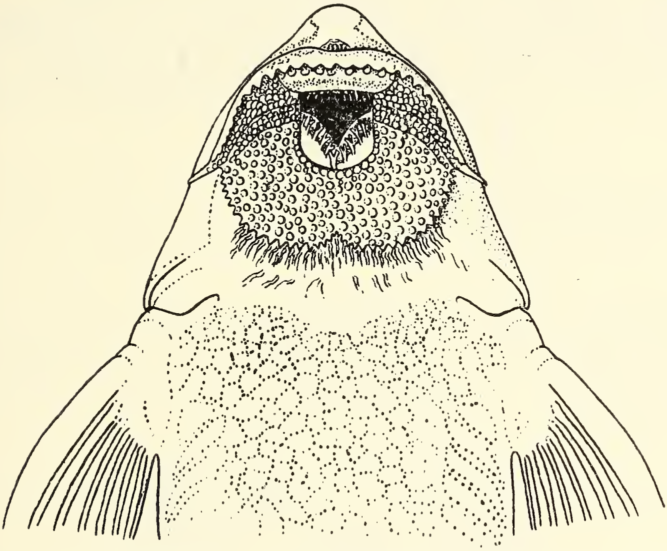


Text-fig. 5.—Lateral view of the Trunk-fish, *Ostracion cornutus* Linn. ×½.

D. Bagchi photo.

TORRENTIAL STREAM.

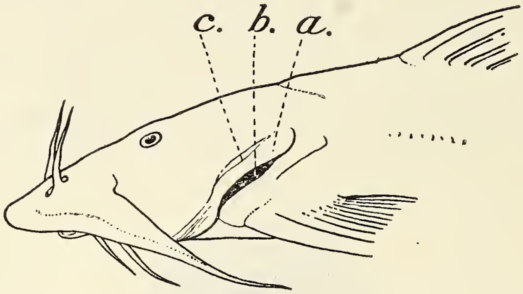
We have so far considered isolated exceptions and seen how the mode of breathing changes with the requirements of the diverse types of fishes. This becomes very clear when entire populations of abnormal habitats, such as torrents and marshes, are taken into consideration. The cold and rapid waters of the hill streams (pl. I) are highly oxygenated and the fish living in them are favourably placed, so far as oxygenation of the blood is concerned, but there are other factors in this habitat which bring about remarkable changes in the mechanism of respiration. In swift currents the fish as a rule lie at the bottom closely adhering to rocks and stones, and consequently their under-surface is greatly flattened and horizontal. The mouth is usually small, and is situated on the under surface considerably behind the tip of the snout. In some fishes the lips are broad and reflected round the mouth to form adhesive organs. As a result of these modifications the normal mode of breathing would seem hardly possible, and judging from the structure of the *Loricariidae*, Regan[6] believed that when these fishes fasten themselves to stones by means of their sucker like mouth 'respiration seems then to be effected by taking in water through the gill openings and expelling it out by the same passage in a reverse direction'. We have already seen that Lampreys breathe in this way when attached to another fish or a rock by their suctorial mouths. This is, however, not the usual mode of breathing in the hill stream fishes. With the exception of a few species all hill stream fishes inhale water through the mouth and expel it through the gill openings. But in spite of



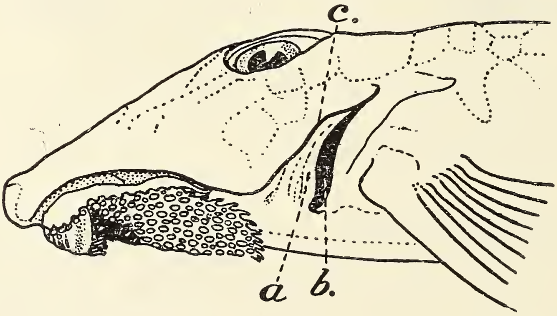
Text-fig. 6.—Ventral surface of head and anterior part of body of *Loricaria strigilata* Hensel. ×2.

Notice the broad, papillated lips that are reflected round the inferior mouth and serve as organs of adhesion.

this the mechanism of respiration is different. It has been observed that during respiration the mouth remains open throughout,[7,8] and that the respiratory current is initiated and carried on by the vigorous pumping action of the membranous flaps of the gill covers. The current thus set up flows in through the mouth and out of the gill openings. In the Indian hill stream fishes it is the upper portion of the opercular flap that performs this function, whereas in *Loricaria*, a South American Cat fish,[9] it is the lower portion that is specially modified for this purpose.

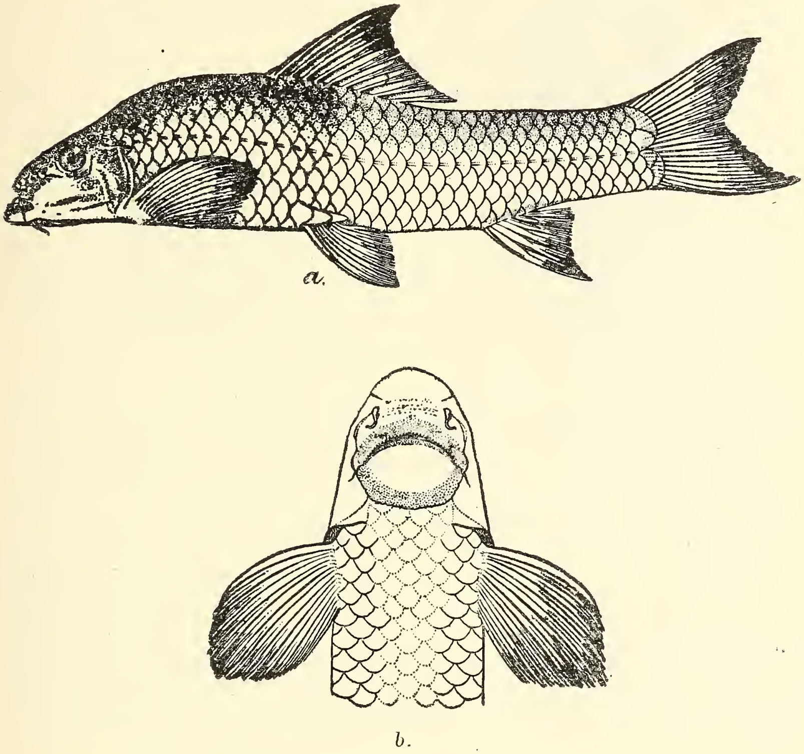


Text-fig. 7.—Lateral view of head and anterior part of body of *Glyptothorax pectinopterus* (McClell.).
(After Hora, *Current Science*, p. 35, 1932).
a: opercular flap; *b*: gill opening; *c*: limit of the bony operculum.



Text-fig. 8.—Ventro-lateral view of head and anterior part of body of *Loricaria strigilata* Hensel. ×2.
a: opercular flap; *b*: gill opening; *c*: limit of the body operculum.

The mechanism of respiration of a typical hill stream fish, such as *Garra*, is like this: the anterior portion of the head is slightly elevated above the substratum and the mouth is kept open. The upper portion of the gill membrane beats vigorously and pumps out the water from inside the gill chamber. When this happens a further supply of water is sucked in through the open mouth, and thus the respiration goes on. But every now and then, at irregular intervals, the entire gill cover is lifted, as if the fish takes a long breath. This movement is probably helpful in ridding the pharynx of obnoxious particles. Another hill stream fish *Balitora* was observed to 'cough' out undesirable particles with considerable force, the object was sometimes thrown out to a distance of an inch or so. The most interesting feature of these fishes is that they are capable of suspending their respiratory movements for a shorter or a longer period, and, I believe, this is helpful in nature when the fish adheres very firmly to rocks. This periodic suspension of respiration is made possible by the fact that the gill openings are greatly reduced so that water can be retained in the gill chambers. The low temperature of the waters of the hill streams and their high oxygenation will also be helpful for this purpose. Moreover, while adhering to rocks by

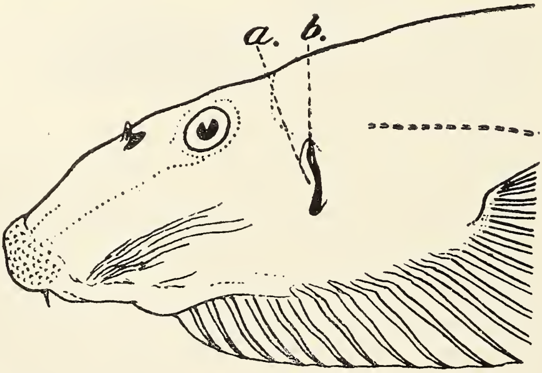


Text-fig. 9.—*Garra arabica* Hora.
a: lateral view; *b*: under surface of head and anterior part of body.
(After Hora, *Rec. Ind. Mus.* xxii, p. 678, 1921).

mechanical devices, the fish does not expend much energy, and, therefore, requires a smaller supply of oxygen.

In a general way I have given the modifications of the hill stream fishes, but to understand them properly it seems advisable to consider the members of one group, *Homalopteridae*[10] for instance. As a result of the flattening of the body, due to the ground habit of life of these fishes, the mouth has gradually shifted from its anterior, terminal position, as in Rohu and Catla, to a subterminal or inferior situation. For the flow of the inspiratory current definite channels are sometimes developed round the mouth as in *Parhomaloptera*. In most of the *Homalopteridae* there is a broad groove in front of the mouth and the same extends backwards round the corners of the mouth. It seems probable that the groove serves as a catchment area for the water that enters underneath the fish at the anterior end. From this groove the water flows into the mouth cavity from the corners of the mouth. The number of barbels and tactile papillae that are associated with this groove are no doubt used for testing the inspiratory current. These characters are so important that they distinguish genera and species in the family.

Text-fig. 10. *Balitora brucei* Gray. (After Hora, *Journ. Bombay Nat. Hist. Soc.* xxxii, p.113, 1927).

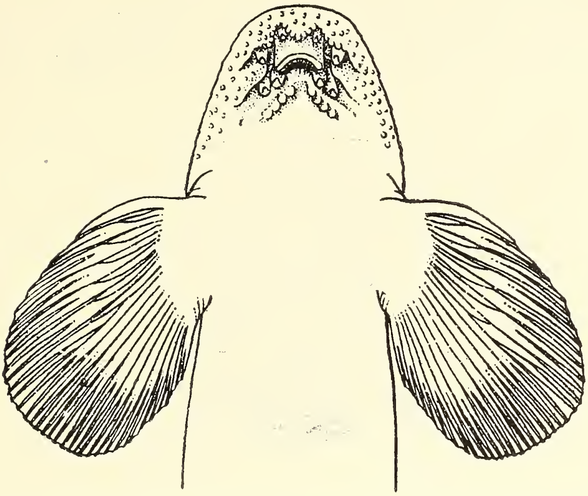


Text-fig. 11.—Lateral view of head and anterior part of body of *Gastromyzon borneensis* Günther. × 2.

a: opercular flap; *b*: gill opening.

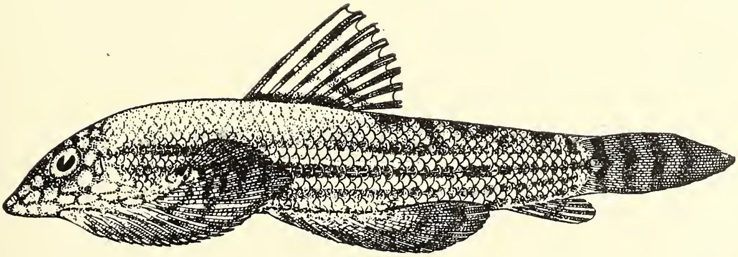
Notice the position of the gill opening, which is small and considerably above the base of the pectoral fin.

In the *Homalopteridae* the gill openings are generally of a moderate size extending obliquely in front of the pectoral fins and on to the under surface for a short distance. It is, however, the upper small portion of the gill opening that functions during respiration. This modification is carried a step further in a number of Homalopterid fishes, in which the gill opening is represented by a small hole above the pectoral fin (text-figure 11). This represents the functional portion of the gill opening, while the lower portion seems to have disappeared altogether.



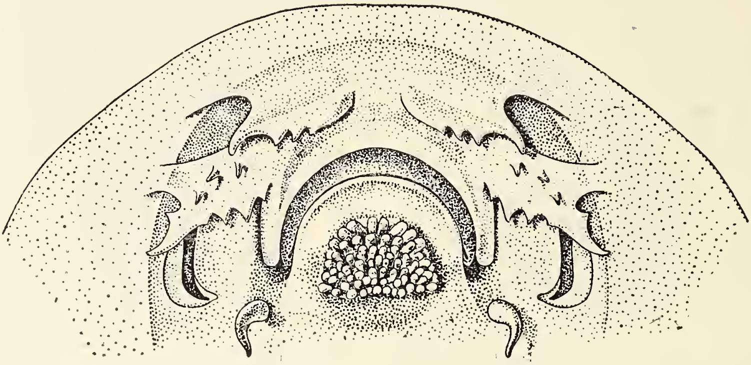
Text-fig. 12.—Ventral surface of head and anterior part of body of *Parhomaloptera microstoma* (Blgr.) to show the nature of the grooves round the mouth. ×3½.
(Modified after Hora, *Mem. Ind. Mus.* xii, pl. xii, fig. 7, 1932).

Among the *Homalopteridae* special mention has to be made of *Sewellia*, a very peculiar fish which I have associated with the name of my distinguished chief, Lt.-Col. R. B. Seymour Sewell. The structure of its rostral barbels and the rostral groove is unique



Text-fig. 13.—Lateral view of *Sewellia lineolata* (C.V.). ×2.
Notice the greatly reduced gill opening behind the eye.
(After Hora, *Mem. Ind. Mus.* xii, pl. xi, fig. 10, 1932).

among fishes. Each rostral barbel is plate like at its base and stretches across the rostral groove; it is provided with fringed edges and terminates in a small barbel like process. The bases of the two inner rostral barbels are united with each other, thus forming a floor to the rostral groove in the middle. The most interesting feature of the fish is that near each corner of the mouth the rostral groove possesses an oval aperture which seems to communicate with the oral cavity. It is, therefore, highly probable that in *Sewellia* the inspiratory current is not taken in through the mouth-opening, but passes directly from the rostral groove through the aperture mentioned above into the oral cavity. The peculiar rostral barbels act as guards to prevent the entry of undesirable objects into the rostral groove.

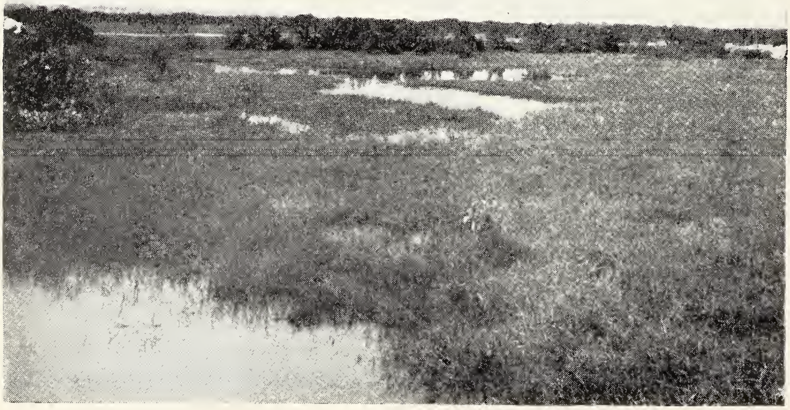


Text-fig. 14.—A part of the ventral surface of head of *Sewellia lineolata* (C.V.) showing the mouth and the associated structures. ×15.
(After Hora, *Mem. Ind. Mus.* xii, p. 316, 1932).

So far no observations have been made on the living specimens of *Sewellia* and it is a mere surmise that the mouth is not used as an inlet for the respiratory current. In *Gyrinocheilus*, a mountain Carp known from Borneo and Siam, and in *Arges*, a Cat fish of the Andes in South America, it is a well known fact that on account of the peculiar habits of these fishes the mouth no longer serves as a passage for the inspiratory current, and that the gill openings are modified in a remarkable way for this purpose. Each gill opening is divided into an upper slit like portion, which serves as an inhalant opening and communicates with the posterior part of the mouth cavity immediately in front of the gills; and a lower much wider portion which serves as an exhalant aperture and is guarded by a large membranous flap. Vaillant[11] attributed the respiratory movements of this fish to the expansion and contraction of the walls of the oral cavity, but Smith[12] has recently observed the vigorous movements of the opercular or the gill cover flaps—230 per minute. I believe that in *Gyrinocheilus*, as in all other hill stream fishes, such as those that I have discussed already, the

H. M. Smith, photo.

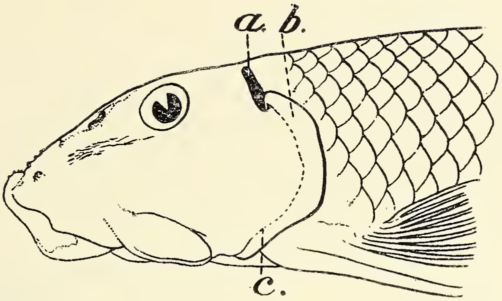
Habitat of *Gyrinocheilus.*



D. Bagchi, photo.

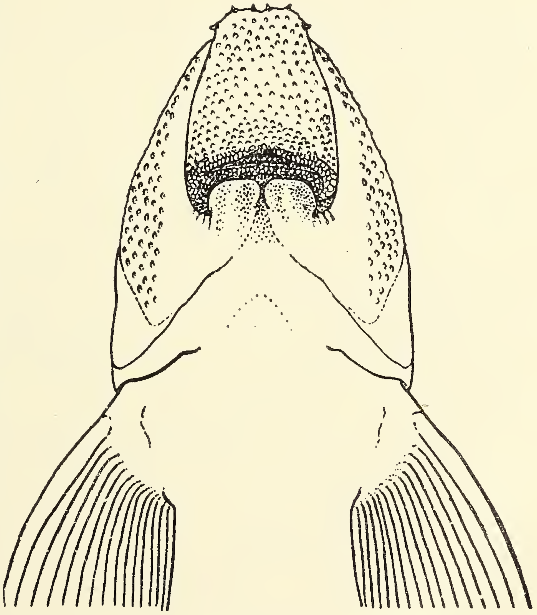
Habitat of Indian air-breathing fishes.

respiratory current is initiated and carried on by the opercular flaps of the exhalant openings.



Text-fig. 15.—Lateral view of head and anterior part of body of *Gyrinocheilus kaznakoi* Berg.
(After Hora, *Current Science*, p. 35, 1932).
a: inhalant aperture; *b*: opercular flap of exhalant aperture; *c*: limit of bony operculum.

Gyrinocheilus is said to feed solely on nutritional matter contained in mud and the lips, which surround the mouth and form a funnel like sucker, are believed to scoop up the mud as well as to enable the fish to cling to stones and other objects. In a typical hill stream (plate II, top-fig.) there is generally no mud to scoop up, and, therefore, I am inclined to agree with Smith[12] who after observing these fishes in an aquarium states that its mouth parts are adapted for scraping algae from stones and other submerged objects. According to him the favourite attitude of the fish, assumed for protracted periods, was to lie in a vertical position against the glass front of the aquarium several feet above the bottom. The mouth, in the circumstances, has become so specialized for attachment that the circulation of water through the mouth

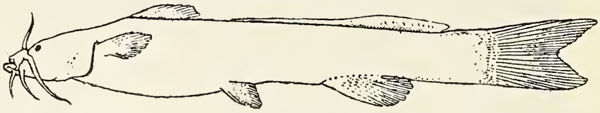


Text-fig. 16.—Ventral surface of head and anterior part of body of *Gyrinocheilus kaznakoi* Berg showing the nature of the mouth and of the associated structures. ×1½.

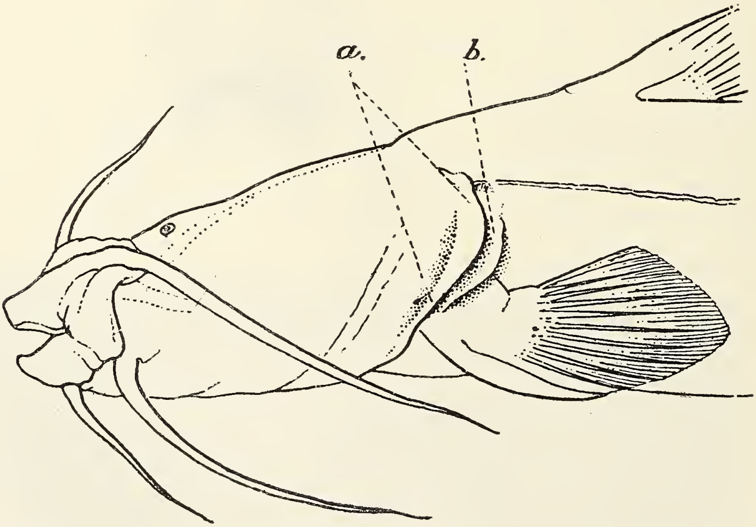
has become impossible, and if there were no other means for respiration the fish would have to release its hold in order to breathe. It is to obviate this difficulty that the gill openings have become so peculiarly modified.

In *Arges* the lips are very broad and reflected round the mouth and it is well known that they are used for fastening the fish to the substratum. So in *Arges*, quite independently of the evolution in *Gyrinocheilus*, the gill openings have become modified in exactly the same way into inhalant and exhalant apertures.

There is one more hill stream fish—*Amblyceps mangois*—to which attention may be directed before passing on to a very different group of fishes that breathe air directly from the atmosphere. *Amblyceps* lives in small streams at the base of hills and I have studied this fish in its natural haunts in the Sevoke stream in the Teesta Valley below Darjeeling. It is a very variable fish, especially with regard to its tail fin and the adipose dorsal fin. It is a voracious feeder, bites viciously and is known to be capable of living out of water for some time. The streams in which *Amblyceps* is usually found are liable to become raging torrents after rainstorms, while during the dry months these streams become cut up into a series of pools and puddles. In a torrent it lives at the



Text-fig. 17.—Lateral view of *Amblyceps mangois* (Ham. Buch.). ×2.



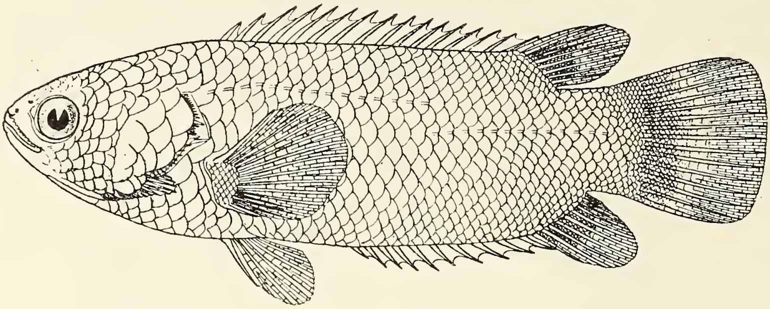
Text-fig. 18.—Lateral view of head and anterior part of body of *Amblyceps mangois* (Ham. Buch.).
a: opercular flap; *b*: flap of skin behind the gill opening.

bottom among stones and pebbles and breathes spasmodically like most of the other hill stream fishes—the current enters the mouth and is expelled through the upper portion of the gill opening, the membranous flap of the gill cover initiates and carries on the current. Unlike other hill stream fishes, the gill openings of *Amblyceps* are very wide, and consequently a flap of skin is developed behind the gill opening which enables the fish to close the aperture during periods of rest. This structure is not found in any other fish. When the stream begins to dry up, the fish probably wriggles itself into pools.

In all the instances that so far have been studied, there is strong evidence that the evolution or the modification of the respiratory organs in fishes is purposive, and that it is the direct result of the habits of the organisms concerned. We shall now consider the typical air breathing fishes and the circumstances that gave rise to them.

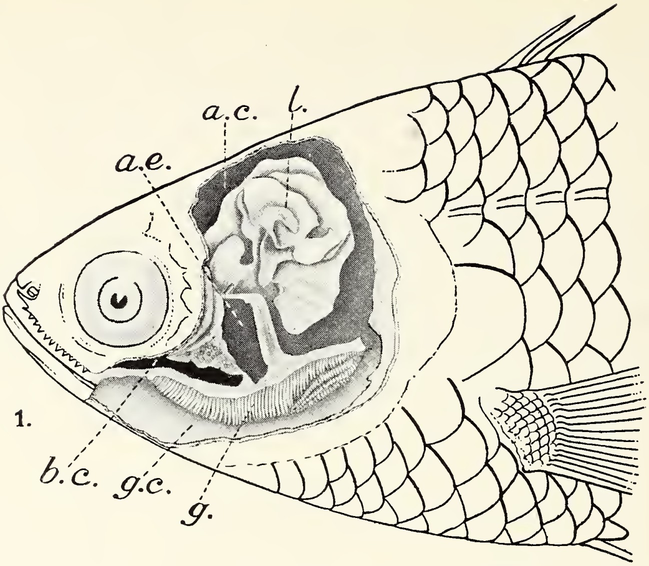
In India we are quite familiar with a variety of air breathing fishes, such as KOI (*Anabas*), MAGUR (*Clarias*), SINGI (*Saccobranchus*), CUCHIA (*Amphipnous*), SAULI (*Ophicephalus*) and others. Our jugglers go about and exhibit some of these fishes walking on dry ground. In this city boat loads of these fishes are imported from outside, and get a ready sale, specially among the Bengali population. They are considered very good for invalids as they are believed to be light, nutritious, strengthening, invigorative and restorative. These are the fishes that are supposed to fall from heaven, for they seem to come from nowhere in ponds and ditches after a heavy shower. The explanation for this is that during the dry season these fishes bury themselves in the mud at considerable depths and aestivate in that condition during the unfavourable season. After a heavy rainfall, when the ground becomes soft, these fishes are awakened from their enforced slumber and come out to populate ponds and ditches. KOI, SAULI and CUCHIA are known to wander from pond to pond in the early hours of the morning. There is a persistent report that KOI is able to climb cocoanut trees, and a young Bengali has described to me how he watched this fish propelling itself along a slanting date palm tree with the help of its gill covers and other parts of its body. I am further informed that shoals of *Anabas* can be seen migrating during the monsoons, and when a slanting tree happens to lie in their way, they begin to climb it as if they were going on land like the other members of the shoal. Of course, the object of climbing is not to eat the cocoanuts. This part of the account may be regarded as a mere fable. In scientific literature the belief obtained currency through the statement of a Danish naturalist, F. de Daldorf[13] who stated to the Linnean Society of London that he had himself seen an *Anabas* in the act of ascending a palm tree which grew near a pond. He further stated that the fish had reached the height of 5 feet above the water, and was going still higher. In the effort to do this, it held to the bark of the tree by the preopercular spines, bent its tail, and stuck in the spines of the anal fins; then released its head, and raising it, took a new hold with the preoperculum higher up. In the Malay language the fish is named the 'Tree

Climber' and in Tamil it is called the 'fish that climbs palmyra trees'. In spite of these anecdotes and observations the tree-climbing habits of *Anabas* were discredited and the Danish naturalist's account was characterized as foolish even by the most observant Indian naturalist, Francis Buchanan.[14] According to Buchanan-Hamilton[15] the presence of *Anabas* on trees may be due to the following causes: 'The palm, as is often the case with those of its species (*Borassus flabelliformis*), may have been growing with its lower parts nearly horizontal, and the fish may have then moved along it, as well as on the land; or the palm may have been covered with the knobs, often left by the cultivators when they remove the branches (stipites), and the fish may have been left among these knobs by some bird, and might, no doubt have continued wriggling among them'. Dr. Das[16] does not doubt the fact that these fish are sometimes found on trees, but he thinks that crows and kites probably seize the fish and deposit it high up in the forks of branches of trees to be devoured at leisure. This is expecting too much from our crows and kites, for we know that they will not wait to finish the juicy meal if they happen to seize a fish. Das's explanation, which seems to have been based on Buchanan-Hamilton's surmise, is far from convincing. Dr. Sundara Raj,[17] the Director of the Madras Fisheries, states that one of his assistants was able to demonstrate experimentally that the 'climbing perch' is really capable of climbing 'up a nearly vertical sheet of cloth, when held over the water in the aquarium' in which it was kept. Madaliar and Mitchell[18] also carried out experiments which show the reliability of the early reports. Highly improbable as it may appear, it is likely that *Anabas* sometimes climbs trees accidentally though I have never witnessed a display of its extraordinary scansorial powers.



Text-fig. 19.—*Anabas testudineus* (Bloch). ×¾.
The so-called 'Climbing perch' of India.

I hope you will excuse me for having digressed from the subject-matter of my lecture to clear up an interesting point of great biological interest, but my real object was to make it sufficiently clear to you that *Anabas*, when progressing on land or climbing a tree, is apparently like a terrestrial vertebrate breathing air direct from the atmosphere. But if the fish keeps away from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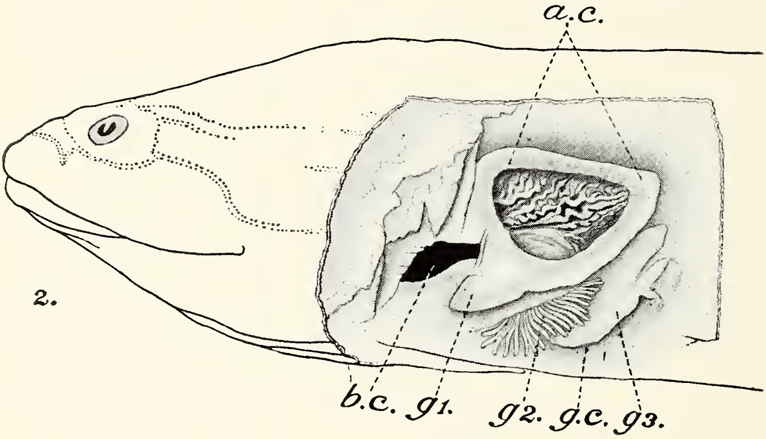
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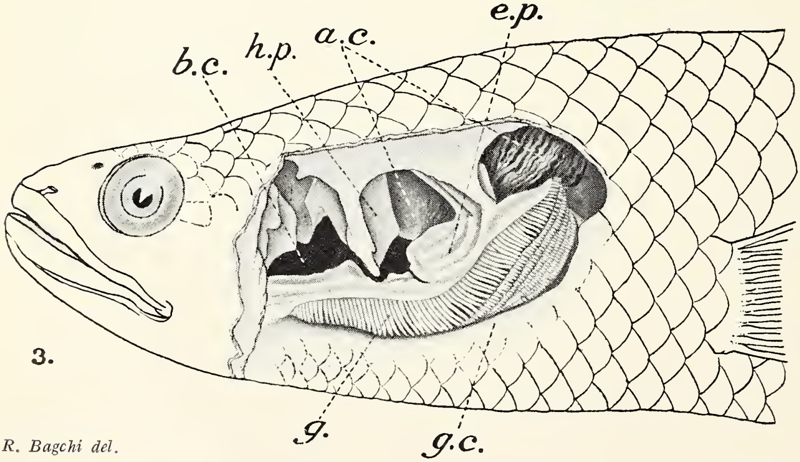
2.


e.p.
b.c.
h.p.
a.c.
g.
g.c.

3.

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water for more than 6 to 7 hours, it dies. This may probably explain the fact that dead fishes are found on trees. *Anabas* can climb with the help of its spines, but it can reach the ground afterwards only by dropping down. It is likely, therefore, that some fish after climbing get stranded and die through prolonged desiccation. Water is still very essential for the proper respiration of KOI. On the other hand, it is equally true that *Anabas*, as well as other air-breathing fishes, can be drowned by keeping them in water and not allowing them to come to the surface to breathe air. Day,[19, 20] and other earlier workers demonstrated this experimentally and recently Das[16] repeated some of these experiments with similar results. Even in highly oxygenated waters these fishes get suffocated. The explanation of this is to be found in the habitat of the fish as well as in its organs of respiration. On lifting a gill cover one sees a chamber situated above the gills and formed as an outgrowth of the ordinary gill chamber (plate III, fig. 1). Each chamber contains a labyrinthiform organ, composed of shelf like plates with wavy edges and supplied with fine blood vessels. When the air is inhaled through the mouth it enters this chamber and the labyrinthiform organ acts as the 'lung' of the fish.

In SAULI (*Ophicephalus*) the accessory respiratory organs are in the nature of two lung like reservoirs in the head, developed as pouches of the pharynx (pl. III, fig. 3). The inner lining of these cavities are richly supplied with blood. The respiratory chambers of CUCHIA (*Amphipnous*) are of a similar nature (pl. III, fig. 2). In this fish the gills are greatly reduced and it seems to have lost practically all its power of aquatic respiration. In MAGUR (*Clarias*) there is an air chamber situated above the gills into which tree like outgrowths project from the upper ends of the gill arches (pl. IV, fig. 3). In SINGI (*Saccobranchus*) a long tubular sac grows backwards from the opercular or the gill cavity and extends as far as the middle of the tail (pl. IV, fig. 1). This sac bears a marked resemblance to the lungs of land vertebrates (pl. IV, fig. 2).

Reference may also be made to some non-Indian air breathing fishes[21]. *Hoplosternum** lives in the swamps of the Paraguayan Chaco in South America and uses a part of its intestine as the accessory respiratory organ. The respiratory part of the intestine is thin walled and transparent, and occupies the greater part of the body cavity. In another fish—*Ancistrus*—that lives in company with *Hoplosternum* the large U shaped stomach is always full of gas during life and has been found to serve as a respiratory organ. In *Erythrinus* the central part of the air bladder, which extends throughout the whole length of the abdominal cavity and occupies more than one half of its space, has become lung like, is highly vascular and is consequently red in colour. In the thickness of its walls are cavities similar to those found in lungs.

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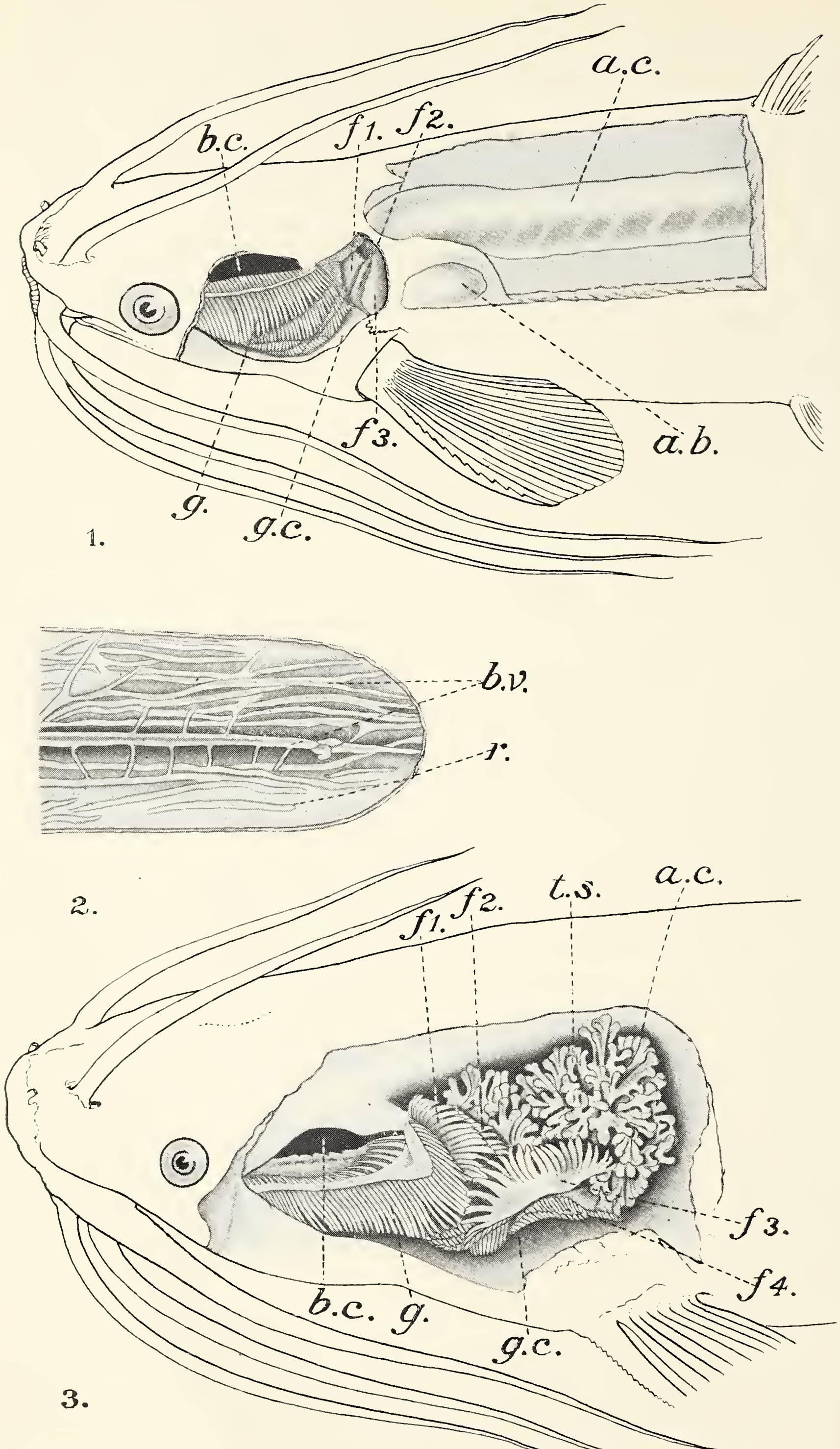
* Excellent illustrations of the habitat and structural modifications of *Hoplosternum*, *Ancistrus*, *Erythrinus*, etc. are to be found in Carter and Beadle's paper referred to in the list at the end.

In *Erythrinus*, it has been mentioned, the air bladder acts as a lung, but the real fact is that the air bladder of our modern bony fishes is a modified or degenerate lung. This conclusion has been reached by studying the structure and habits of an ancient group of fishes, the *Dipnoi* or the real double breathers. The *Dipnoi* are found in Australia, Africa, and South America in marshy places where the water is poor in oxygen. The air bladder is used as a definite lung and the structure of its walls are very much like a vertebrate lung. During periods of drought the fish aestivates in burrows where it forms a cocoon round itself leaving an aperture through which it can breathe air. In their structure the *Dipnoi* are considered to be intermediate between the true fishes and the amphibians, and are no doubt the relics of an ancient group that flourished as early as the Silurian and Devonian epochs. It is strongly believed that animals with the habits and the structure of the Dipnoan fishes made the evolution of the terrestrial vertebrates possible.

In the Silurian and Devonian epochs the conditions were probably very favourable for the evolution of the air breathing fishes and such of their kind that were taking to an absolutely terrestrial life, but later with the arrival of the fish eating reptiles and to several other factors, a large number of them went back to the sea probably for safety. In this environment they found an adequate supply of oxygen for gill breathing and, in consequence, the lungs more or less lost their respiratory function and became either modified into a functionally different organ known as the air-bladder, or disappeared altogether. It is believed that a majority of our bony fishes, both freshwater and marine, are the descendants of those that went back to the sea in the old days. Organic evolution is both progressive and retrogressive. It is further seen how different forms result simply by the modifications of pre-existing structures induced by changes in habits and habitats. It seems probable that fishes with gills and accessory respiratory oragns are physiologically better adapted for invading brackish waters than those that breathe by their gills alone, and today most of the freshwater fishes, that are taking to life in brackish waters, are those that are provided with means of breathing air directly from the atmosphere.

Most of the air breathing fishes, in fact all those that we have discussed so far, are found in shallow, stagnant, tropical freshwaters (pl. II, bottom fig.), which are liable to dry up during the dry season. Aerial respiration in fishes seems to have evolved in response to a lack of oxygen in the water, and it is conceivable that periodic droughts provided the stimulus for migration on to the land. There are, however, a few marine fishes that have taken to aerial respiration, and to them, the above explanation cannot be applied. *Periophthalmus*, the well-known mud-skipper, is very common in brackish waters not very far from Calcutta. It spends a considerable part of its time out of water, ''walking'' or skipping about on the mud flats of mangrove swamps at low tides in search of food. It is also fond of climbing on to the mangrove roots or of basking in the sun perched on a stone in a pool. Some-


a.c.
f1.
f2.
b.c.
f3.
a.b.
g.
g.c.
1.
b.v.
r.
2.
t.s.
a.c.
f2.
f1.
f3.
f4.
b.c.
g.
g.c.
3.

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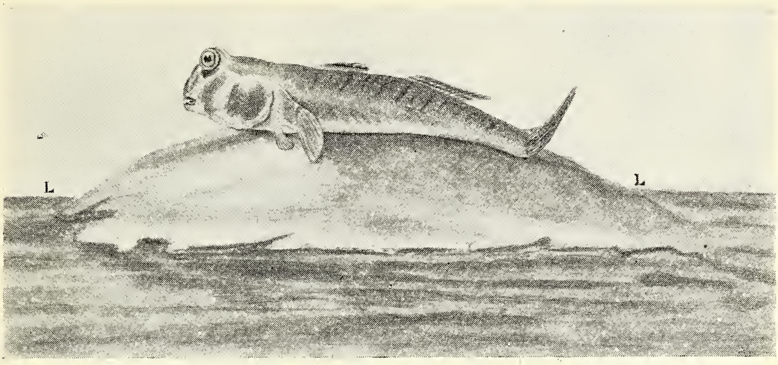
how an absolutely wrong notion has gained currency in scientific literature[22] that this fish leaves its tail hanging in water for the purpose of respiration. Those, who have studied this fish in its natural haunts, are familiar with the fact that it spends most of its time entirely out of water. In such circumstances its respiration is aerial, the large opercular cavities are kept filled with air, as can be readily noticed from their greatly bulging cheeks. It is conceivable that the silt laden waters of the estuaries, the periodic immersion and desiccation on account of the rise and fall of tides or the habit of chasing prey may have caused the evolution of aerial respiration in *Periophthalmus*. The fish propels itself with the help of its paired fins and is very active in its movements. Its large moveable eyes enable it to see in all directions and on the slightest provocation it jumps back into the water again.

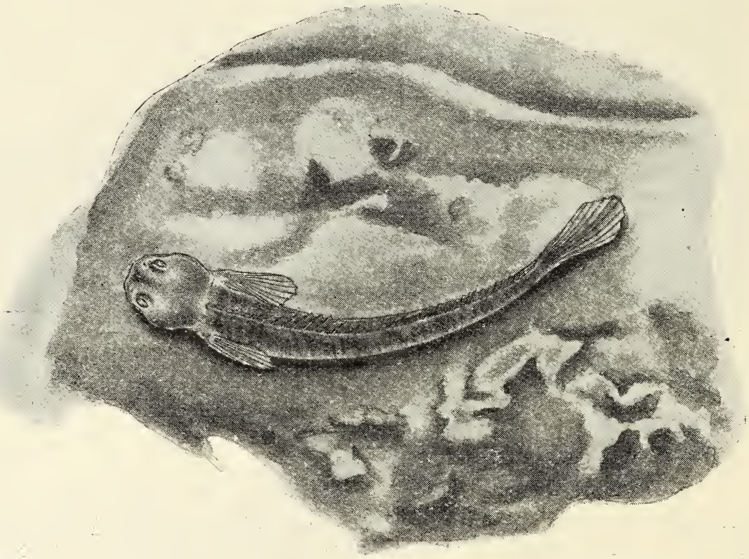


Text-fig. 20.—The Mud-skipper, *Periophthalmus schlosseri* (Pall.). On a piece of broken pottery in an aquarium (Diagrammatic). Notice the fish is entirely out of water and its caudal fin is turned upwards (not an uncommon attitude), showing thereby that the story of caudal respiration in *Periophthalmus* is only a myth. Attention may here be directed to the bulging cheeks of the fish in which air is normally stored for respiration. L = water level.

There are several other estuarine Gobioid fishes, such as *Boleophthalmus*, *Taenioides* and *Pseudapocryptes*, which live in similar situations as *Periophthalmus*. Though they are not as active as *Periophthalmus*, their mode of aerial respiration is very similar. They are capable of inhaling air direct from the atmosphere and storing it in their opercular cavities. If not allowed access to atmospheric air, they are readily 'drowned'. *Periophthalmus* and *Pseudapocryptes* have been found by me aestivating in the bed of dried up pools at considerable depths from the surface.

Of all the air breathing fishes *Andamia*[23] is the most remarkable. It lives on rocks just beyond the surf line where it is kept moist by the spray of the dashing waves. The sea water is highly oxygenated in this region, and the fish has no prey to chase as it lives on slime and algae encrusting rocks and stones. The sucker behind the mouth and the broad and horizonal pectoral fins enable the fish to adhere to rocks. This fish also possesses moveable eyes and is very alert and agile in its movements.

Andamia is a Blennid fish, popularly known as rock skipper. Some of these live in the rock pools of the tropics and leap from rock to rock with the agility of lizards. 'One of them, *Erpichthys* or *Alticus saliens* in Samoa, lives about lava rocks between tide-marks, and at low tide remains on the rocks, over which it runs with the greatest ease and with much speed, its movements being precisely like those of *Periophthalmus*'[24]. The Blennids thus provide an evolutionary series, but even then it is difficult to infer what could have been the stimulus for adopting aerial respiration. It may be that rock pools formed a nursery for the evolution of such an adaptation. In *Andamia* the large opercular chambers serve as accessory organs of respiration and, I believe, the pseudobranchs, which are well developed and project freely in this chamber, are used for the oxygenation of blood.



Text-fig. 21.—The Rock skipper. *Andamia heteroptera* (Bleeker) on a piece of rock just beyond the surfline. Notice its bulging cheeks in which air is stored for respiration.

(Modified from a photograph by Dr. S. B. Setna).

From what has been said it is abundantly clear that the ways of Nature are greatly diversified, and that to attain the same object it employs a number of apparently different methods. In each case, however, one notices a close adjustment between the organism and the external conditions of its existences. It is this harmony pervading through Nature that makes its study so charming and interesting. To those, to whom Nature seems only 'red in tooth and claw', the full significance of wonderful adaptations is not clear. We have seen that whenever and wherever circumstances demanded aerial respiration in fishes, it was evolved in so many different ways.

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EXPLANATION OF PLATES.

PLATE I.

A torrential stream in the Khasi Hills near Dumpep; Pun-wa-Sherra stream below Shillong-Cherrapunji Road, 3 miles beyond Dumpep.

PLATE II.

Top:—The Khan River, Northern Siam. The Khan is a clear, cool and swift stream; it is a tributary of the Ping River. Photograph taken by Dr. H. M. Smith, 1932.

Bottom:—A swampy area overgrown with grass near Dhapa Lock, Calcutta. It is a favourite haunt of several species of *Ophicephalus* and of other air breathing fishes, such as *Anabas*, *Clarias*, *Saccobranchus*, etc.

PLATE III.

MECHANISMS OF AERIAL RESPIRATION.

Fig. 1.—Dissection of *Anabas testudineus* (Bloch), showing the nature and position of its Respiratory Organs. *ca* ×1⅔.

The accessory respiratory organs of *Anabas* consist of two air chambers (*a.c.*), which are situated at the sides of the head above the gill cavities (*g.c.*). Anteriorly they extend as far as the hinder end of the orbit and dorsally they encroach upon the cartilages of the auditory regions. The air chambers contain the remarkable 'labyrinthine' organs (*l*), each of which consists of three plates and is known to have developed as an outgrowth from the epibranchial segment of the 1st branchial arch. The entire structure is the result of two successive outgrowths of the epibranchial shelf.

Each chamber communicates with the pharynx (*b.c.*) through the first gill slit, and with the gill cavity through a special air exit (*a.e.*) just between the hyoid and the first branchial arch. The air passes into the chamber from the gill slit and out of it through the special passage to the gill cavity. The course of circulation of the air is controlled by valves.

The blood is oxygenated in the vascular lining of the labyrinthiform organs as well as in the lining of the air chambers. It may be noticed that with the development of accessory respiratory organs the gill cavities as well as the gills (*g.*) are greatly reduced in size.

Fig. 2.—Dissection of *Amphipnous cuchia* (Ham. Buch.), showing the nature and position of its Respiratory Organs. *ca.*×1⅔.

The accessory respiratory organs of *Amphipnous* consist of a pair of lung like sacs (*a.c.*) developed from the dorsal walls of the pharynx (*b.c.*). When fully developed they extend as far back as the third branchaial arch. The inner walls of these sacs are raised into complicated folds, so that the structure comes to resemble superficially an Amphibian lung.

Each sac communicates with the mouth cavity through a large hole which is surrounded by muscles. The hole opens, when the mouth is opened, thus allowing the air to enter the air chamber. The expulsion of the air is brought about partly by the contraction of the muscular walls of the sacs and partly 'by the spring like action and pressure caused by the opercle and the subopercle'. The air is thus forced out through the narrow gill slits and escapes by the single, median branchial opening.

The blood is oxygenated in the air-sacs as well as in the pharynx, the inner lining of which is also vascular. With the acquisition of air breathing habit, the gills (*g*1, *g*2 and *g*3) are greatly reduced, and in the adult condition they are represented by a few finger like filaments on the second gill arch only. The first and the third gill arches are provided with flaps of skin. The gill cavity (*g.c.*) is very shallow. It is thus seen that *Amphipnous* is the most highly modified of all the air breathing fishes, for in no other fish the organs of aquatic respiration are so greatly reduced.

Fig. 3.—Dissection of *Ophicephalus punctatus* (Bloch), showing the nature and position of its Respiratory Organs. *ca.* × $1\frac{2}{3}$. The buccal cavity is enlarged by keeping a piece of cork in the mouth.

The accessory respiratory organs of *Ophicephalus* consist of a pair of incompletely bipartitioned air chambers (*a.c.*), one on each side of the auditory region of the skull. Each air chamber develops as a pouch of the pharynx above the first gill arch, but grows backwards behind the auditory region and in the adult condition extends as far as the last pharyngeal cleft.

Two processes—the hyomandibular process (*h.p.*) and the epibranchial plate of the first gill arch (*e.p.*)—project into the chamber. The epibranchial of the second gill arch as well as the narrow base of the brain case send processes into this chamber. The lining of these processes and of the chamber is very vascular. In the adult condition the lining of the hindermost portion of the chamber is thrown into ridges and grooves, and presumably it is the chief centre of aerial respiration.

Each air chamber communicates freely with the mouth. 'When the mouth is opened and the branchial apparatus pulled down air rushes into the air chambers and below the ventral edge of the hyomandibular process into its posterior division. When the mouth is shut and the gill arches raised this process cuts off communication between the anterior and posterior regions of the air chamber, and the air now escapes through the tube formed by the opposition of the two processes into the opercular chamber and so to the exterior'.

With the adoption of aerial respiration the gills and the cavities are considerably reduced.

PLATE IV.

Fig. 1.—Dissection of *Saccobranchus fossilis* (Bloch), showing the nature and position of its Respiratory Organs. *ca* × $1\frac{2}{3}$. The third 'fan' is raised to show the opening between it and the second fan.

The accessory respiratory organs of *Saccobranchus* consist of a pair of long, tubular sacs (*a.c.*), which develop as evaginations of the gill chambers (*g.c.*) between the hyoids and the first branchial arches. In the adult condition each sac extends as far back as the middle of the tail region. 'In the hindermost part of the sac the epithelium is folded into a number of ridges, which unite with one another and enclose 'alveoli' which resemble the alveoli of a frog's lung'.

The air chamber communicates with the buccal cavity (*b.c.*) through a small slit which is left between the third 'fan' and the second 'fan', when the former comes to lie over the latter. This opening serves as a passage of air in and out of the air chamber.

The blood is oxygenated in the walls of the air chambers which derive their blood supply from the afferent and efferent vessels of the fourth branchial arch. The gills are not very much reduced and the gill cavity is of fairly spacious dimensions.

Fig. 2.—The hindermost part of the air chamber of *Saccobranchus fossilis* (Bloch) cut open to show the nature of its inner lining. *ca* × $2\frac{1}{2}$.

The blood vessels (*b.v.*) indicate the vascular nature of the lining, and the ridges (*r.*) show how the respiratory area of the sac has been increased.

Fig. 3.—Dissection of *Clarias batrachus* (Linn), showing the nature and position of its Respiratory Organs. *ca* × $1\frac{2}{3}$.

The accessory respiratory organs of *Clarias* consist of two tree like structures (*t.s.*) which are contained in an air chamber (*a.c.*) situated above the gills (*g.*), the posterior one is the larger of the two, but both are developed from the upper ends of the gill arches (second and fourth). The air chamber is a dorsal outgrowth from the gill chamber; in the adult condition it occupies a large space adjacent to the otic capsule. The two chambers almost approximate in the mid dorsal line. The tree like structures are covered with a highly vascular lining, and vascular tongues also project from the sides and roof of the air chamber.

Each air chamber communicates with the gill cavity through a somewhat narrow, tubular neck. 'The uppermost gill filaments growing from each branchial arch cohere to form a "fan" or "valve" which projects into the air chamber.' Between the second and third 'fans' (*f*2, *f*3) is the opening through which air passes from the pharynx into the air chamber, while the exit passage is situated between the third and fourth 'fans' (*f*3, *f*4).

The blood is oxygenated in the vascular lining of the tree like structures as well as of the air chamber. Though apparently the gills are not very much reduced, a considerable part of the gills is modified into 'fans'.

EXPLANATION OF LETTERING IN PLATES III AND IV.

a.b.—air bladder.
a.c.—air chamber.
a.e.—air exit.
b.c.—buccal-cavity or pharynx.
b.v.—blood vessels.
e.p.—epibranchial plate of first gill arch.
*f*1, *f*2, *f*3, *f*4—'Fans' or 'valves' to control circulation of air inhaled.
g.—gills.
*g*1, *g*2, *g*3—first, second and third gill.
g.c.—gill cavity.
h.p.—hyomandibular process.
l.—labyrinthine organ.
r.—ridges of the respiratory surface.
t.s.—tree-like structure for aerial respiration.

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS (ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., assisted by N. B. KINNEAR, M.B.O.U.

PART V.

(*Continued from page* 352 *of volume* xxxvi).

Acrocephalus stentoreus brunnescens (Jerdon).[1]

Agrobates brunnescens Jerdon, Madras Journ. Lit. Sci., vol. x, 1839 (after October) p. 269—Trichinopoly.

Not obtained by the survey. There are surprisingly few records of the Great Reed-Warbler within our limits. Apart from unsexed and undated birds marked Malabar 1848 (Eyton Coll.) and Coorg (2 Tweeddale Coll.) in the British Museum. We have examined only two specimens namely ♂ 11-12-1879 Collegal, Coimbatore (Hume Coll.) and ♀ 26-4-1910 Thodupuzha, Travancore (Nair).

Davison thought that he saw two in a rose hedge in a coffee-estate in Charambady, Wynaad on 2 April (S.F., x, 390) and Ferguson obtained a single specimen in Travancore (J.B.N.H.S., xv, 456).

The only other record we can trace is Jerdon's statement, on which is based the type locality, that he had met it at Trichinopoly. Colonel Sparrow however informs us that on 1 February 1913 he found it common at the Colair Lake near Bezwada.

Acrocephalus dumetorum Blyth.

Acrocephalus dumetorum Blyth, J.A.S.B., vol. xviii, 1849 (after August) p. 815—India, Calcutta.

Specimens collected.—17 ♀ 11-4-29, 40-14 ♀♀ 13-4-29, 69 ♀ 17-4-29, 159 ♂ 30-4-29 Kurumbapatti; 947 ♂ 31-10-29, 995-998 ♀o? ♀♂ 11-11-1929, 1010 ♀ 16-11-29 Nallamallai range 2,000 ft.; 1139 ♀ 19-12-29, 1230-1233 o?o?♂o? 12-1-30, 1247-1249 ♀♂♂ 14-1-30, 1253-1254 ♀o? 15-1-30, 1283 ♂ 20-1-30, 1301 ♂ 24-1-30, 1303 ♂ 25-1-30 Godavery Delta; 1491 ♀ 7-3-30, 1529 ♀ 13-3-30, 1551 ♀ 16-3-30, 1567-1568 ♀♀ 19-3-30, 1583 ♂ 23-3-30, 1587 ♀ 1596 ♀ 24-3-30, 1602 ♂ 26-3-30, 1619 ♀ 28-3-30, 1631 ♂ 31-3-30, 1641 ♀ 2-4-30, 1672 ♂ 12-4-30 Sankrametta 3,000-3,500 ft.; 1711 ♂ 20-4-30, 1712 ♀ 21-4-30, 1751 ♀ 30-4-30 Jeypore Agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
14 ♂	15·5-18	61-65·5	50-54	21-23 mm.
22 ♀	15·5-18	59-65·5	48-55	20·5-23 mm.

Wing formula:—2=5/6 to 7/8, usually 6/7.

Blyth's Reed Warbler is evidently a common winter visitor to the Presidency, at any rate on the western side. In Travancore according to Ferguson it is common in the hills and plains from November to April. There are February, March and April specimens in the British Museum. In the Nilgiris also it is recorded as a very abundant winter visitor from the middle of December to late in March (Davison) and this is substantiated by a good series in the British Museum, collected at Coonoor and Ootacamund in January, February and March. There must be some mistake however about Terry's statement (S.F., x, p. 476), that he shot a male at Pittur on 26 June—the specimen is not in the British Museum—and afterwards shot and lost one of a pair at Kukal. Davison states that this species also occurs in the Wynaad and the Brahmagherries and a female collected by him at Manantoddy on 12 April 1881 is in the British Museum.

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[1] The importance attached by both editions of the *Fauna* to the number of tail feathers in the Warbler group is in my opinion quite unsatisfactory and obscures their true relationships. It is not however the function of this paper to discuss genera and families and we have in consequence in these matters merely followed the arrangement and order of species in the *New Fauna*.

On the eastern side our information is entirely confined to that provided by the Survey, namely the five specimens collected at Kurumbapatti in April, the October-November specimens from the Nallamallais and the December-January series from the Godavery Delta, where they were shot in scrub jungle and dense wood in which they skulked in the thickest parts, uttering their characteristic 'chuck' note. Evidently the bird is a winter visitor on this side too.

A large series were also collected in March and April in the Vizagapatam ghats where they were abundant in low bush country about 2,500 ft., ascending also to the highest points 5,000 ft. These birds were exceedingly fat and evidently on migration.

Acrocephalus agricola Jerdon.

Sylvia (*Acrocephalus*) *agricola* Jerdon, Madras Journ. Lit. Sci., vol. xiii, pt. 2 (1845), p. 131—Nellore.

Specimens collected:—1266 ♂ 19-1-30, 1304 ♂ 25-1-30, 1315 ♀ 26-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	14-14·5	56·5-58	53·5	20-21·5 mm.
1 ♀	14	59	57	21·5 mm.

Wing formula:—2=7/8 (2) and 2=8.

Very little is known about the status of the Paddy-field Warbler in the Presidency and it is only known definitely to occur in winter, though I have elsewhere (*Ibis*, 1928, pp. 449-453) discussed the possibility of its breeding in the plains of India. It does not of course breed in Kashmir as stated in the *New Fauna*, vol. ii, p. 395 (corrected vol. viii, p. 639).

In addition to the above three specimens from the Godavery Delta I have examined a male in Colonel Sparrow's collection from the Colair Lake shot on 2 February 1913.

Jerdon's original type came from Nellore where he found the species in paddy-fields in the cold weather.

On the western side there is Hume's record (S.F., x, 390) of a specimen from the Wynaad, and a pair in the British Museum (♂ 13-2-83, ♀ 14-2-83) collected by William Davison in Coorg in the Brahmagherries.

Locustella naevia straminea Seebohm.

Locustella straminea Seebohm, Cat. Birds Brit. Mus., vol. v (1873), p. 117—Etawah.

There are two specimens of this Grasshopper Warbler in the British Museum which suggest that it is a winter visitor to the Madras Presidency, though we can trace no other information about it. They are a female shot on 2 February 1880 at Collegal, Coimbatore (Hume Coll.) and a male shot on 5 January 1871 at Dumagudiam, Godavery Valley (Blanford).

Orthotomus sutorius guzurata. (Latham).

Sylvia guzurata Latham Index Orn. (1790) p. 554—Guzarat.

Specimens collected:—46-48 ♀♂♂ 14-4-29, 62-63 ♀♀ 16-4-29, 84 ♂ 88 ♂ 19-4-29, 120 ♀ 24-4-29 Kurumbapatti; 259 ♂ 21-5-29 Shevaroy Hills 4,800 ft.; 398 juv., 400 ♂ juv. 13-6-29, 416 ♂ 15-6-29 Chitteri range 3,000 ft.; 571 ♀ 21-7-29, 579 ♂ 22-7-29 Gingee; 651 ♂ 4-8-29, 665 ♂ 8-8-29, 701 [♀] 15-8-29, 715 ♂ 20-8-29, 723 ♀ 21-8-29 Palkonda Hills 1,000 ft.; 793 ♂ 4-9-29 Kodur 500 ft.; 852 ♂ 30-9-29, 907 ♀ 12-10-29 Seschachalam Hills 2,000 ft.; 1332 ♀ 6-2-30, 1363 ♀ 10-2-30 Anantagiri 3,000 ft.; 1490 A ♂ 8-3-30, 1660 ♂ 4-4-30 Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
14 ♂ (summer plumage)	15-17	47-51·5	59-81	17-21 mm.
2 ♂ (short tail)	15-16	47·5-51·5	44	20-20·5 mm.
9 ♀	14·5-16	43·5-49	34-41	18·5-20 mm.

The Tailor-bird appears to be so common and so generally distributed throughout the Presidency that there is no need to enumerate the separate records. On the eastern side it occurs from sea-level up to at least 4,800 ft. In Travancore, (from which country I have seen no skins) according to Ferguson it is common in the plains and at the base of the hills, but presumably he did not meet it in the hills, at any elevation. In the Nilgiris, it does not occur much above 6,000 ft. A bird from Rameswaram Island agrees with the Indian form.

About Madras Town, the breeding season appears to be irregular and prolonged. Dewar says that it nests from February to August, the majority perhaps in April. Bates however considers June and July the normal breeding time there, and adds that he saw a newly-fledged family at St. Thomas' Mount in December 1929. On the western side, May, June and July are given as the breeding months.

These Tailor-birds cannot be considered as belonging to the typical race (Ceylon).[1] This latter is a small bird with a comparatively heavy bill and although the difference of colour from the Peninsula bird is not marked it may be said of a series that the rufous cap is more extensive practically absorbing the grey of the nape, the upper parts are a darker green and the lower parts are more uniformly washed with buff. The summer and winter plumages of the adult male in Ceylon are alike, with the central pair of tail-feathers narrow and elongated as in the summer plumage of the Peninsula. Ten males from Ceylon (British Museum: Colombo Museum) measure:—bill 15-17, wing 45·5-49, tail 40-58·5 mm. This difference in the tail is emphasised as one goes northward in the Peninsula. Eight males (summer dress) from Rajputana and the Punjab, taken at random, have tails measuring 64-110 mm.

Cisticola exilis erythrocephala Blyth.

Cisticola erythrocephala Blyth, J.A.S.B., xx, 1851 (after October 17th), p. 523—Nilgiris.

In the Madras Presidency, the Red-headed Fantail-Warbler is apparently confined to the western side. William Davison says that he only found it in the Brahmagherries and in the Peria forest hills and that even there they were rare.

Blyth's original type, collected by Dr. Jerdon in the Nilgherries, is in the Indian Museum, Calcutta. It is undated and in the absence of any other record of this species in the Nilgiris one is inclined to wonder whether it really came from the Wynaad.

According to Terry, who seems however to have been really referring to both this species and *C. j. cursitans*, it was very common at Kukal and near Kodaikanal in the Palnis, and he gives a long note on the habits (S.F., x, 476). A male shot by Fairbank on Mount Nebo 6,000 ft. on 12 June, when two others were also seen, is recorded in Stray Feathers (v., p. 406). Mr. Howard Campbell also found it common in small colonies in the Palnis (*New Fauna*, ii, p. 420).

In Travancore it is only recorded from the High Range, where Ferguson found it fairly common and resident on the grasslands.

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[1] *Motacilla sutoria* Pennant, Ind. Zool. (1769) p. 7—Ceylon.

The breeding is unknown. Admiral Lynes (Review of Genus Cisticola, p. 201) says that judging from the dress of the specimens about May to August would seem to be the principal breeding season, but four juveniles from Coorg in February show that breeding is not confined to the summer.

Cisticola juncidis cursitans (Franklin).

Prinia cursitans Franklin, P.Z.S. 1830-1831 (October 1831), p. 118—Ganges between Calcutta and Benares and in the Vindhyian Hills between the latter place and Gurra Mandela on the Nerbudda.

It is a somewhat remarkable fact that the Rufous Fantail-Warbler was not procured throughout the whole duration of the Survey and one feels that it may be necessary to modify the oft-repeated statement that it occurs throughout India. There are at any rate very few records for the Presidency and these all apply to the western area. It must be cautioned however, that Jerdon (B. of I., ii, 174) states that it occurs in every part of India and he was much on the eastern side.

William Davison says that he met it a few times in the Wynaad near Manantoddy. In Coorg, according to Betts, it is very common and there are specimens from this area in the British Museum.

It occurs in the Palnis at 6,000 ft. and Terry's long account of *C. c. erythrocephalus* (S.F., x, 476) probably applies in part also to this species.

In Travancore Ferguson only records it as occurring in numbers in the paddy fields about Cape Comorin and also about Trivandrum.

Nothing is recorded of the breeding season in the Presidency.

Franklinia gracilis (Franklin).

Prinia gracilis Franklin, P.Z.S. 1830-31 (October 1831), p. 119—Ganges between Calcutta and Benares and in the Vindhyian Hills between the latter place and Gurra Mandela on the Nerbudda.

Specimens collected:—52 ♂ 14-4 29 Kurumbapatti; 637 o? 2-8-29, 644-645 ♂ ♀ 3-8-29, 646 ♀ 4-8-29, 654 ♂ 5-8-29, 661 ♂ 7-8-29, 677 ♀ 12-8-29, 683 ♀ 13-8-29 Palkonda Hills 1,000 ft.; 844-845 ♂ ♀ 28-9-29, 878 ♂ 5-10-29, 923 ♂ 17-10-29 Seschachalam Hills 2,000 ft.; 1349 ♂ 7-2-30 Anantagiri 3,000 ft.; 1586 ♀ 23-3-30, 1624 ♂ 29-3-30 Sankrametta 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
6 ♂ (summer plumage)	12-13	46-49	46-50	17·5-19 mm.
2 ♂ (winter plumage)	12-12·5	47·5-48·5	55-57	18·5 mm.
5 ♀ (summer plumage)	11-12·5	43-47	39-45	17-18 mm.
1 ♀ (winter plumage)	12·5	43·5	55	19 mm.

Franklin's Wren-Warbler appears to be somewhat generally distributed in the Presidency, where it is strictly resident. In the Vizgapatam Hills, La Personne reports that it was not common at the higher altitude of the collecting camps, but at a lower elevation in the Seschachalam and Palkonda Hills it was very common, being found in scrub in thick forest or around villages and to some extent in bamboo jungle. As specimens collected by Blanford about Rajamundri, Ellore and Dumagudiam are in the British Museum it is probably common all down this side as far as those hills. The Kurumbapatti specimen supplies the only other record for the eastern side.

In Coorg and the Wynaad and the slopes of the Nilgiris it is said to occur but not commonly. There are two specimens from Coorg (including the type of *Prinia albogularis* Walden) in the British Museum and three from Wynaad.

Further south in Travancore it is common in the plains and throughout the hill range at all elevations. According to Ferguson it breeds there in May, June and July, preferably at elevations from 300 ft. to 1,000 ft. In one locality he found numbers in the reeds all round the shores of a fresh-water lake.

Franklin's Wren-Warbler is a very difficult bird to study. The summer and winter plumages, each assumed by a complete moult in March-April and September-October-November respectively, are quite distinct and must be considered separately. In winter plumage the bird is brown above and white below, with a long tail. The colour of the upper parts varies from uniform olive brown, washed on the wings and upper tail coverts with chestnut brown, to uniform ashy grey brown, the wings and tail coverts washed with brown. In both phases the upper surface of the tail remains grey. The white underparts have a fulvous and grey wash, the fulvous being more pronounced in the first phase, and the grey more pronounced in the second phase, though both phases have a grey look about the sides of the neck and breast which is characteristic of the species.

In summer plumage it is dark ashy above, white below with a broad ashy pectoral band and the tail is short. The upper parts vary from dark ashy brown, the wings washed with chestnut brown, to dark ashy grey, the feathers washed with brown. In the first phase the white of the underparts is faintly creamy, in the latter pure. Unfortunately, though there appears to be some correlation between the respective phases of the summer and winter plumage, I am unable to satisfy myself as to the extent in which the variation is geographical and therefore subspecific, as the series from southern India and Ceylon in the British Museum is very defective. I suspect, however, the existence of three races, the typical race extending throughout most of Peninsular India, Assam and Burma; a small dark race in Ceylon with summer and winter plumage alike of the summer type, and a 'saturated' race in the Duars. More material is however needed and the problem may be commended to members of the Society.

There is an interesting point about the juvenile plumage of this species. The British Museum contains two juvenile birds (Sikkim, Mandelli) hitherto always accepted as the young of *Franklinia rufescens*. They are very similar to the adult summer plumage of that species with the contrast between crown and back and the rufous upperside to the tail, but the sides of the head and the underparts are washed most conspicuously with pale canary yellow. Prima facie they are obviously the young of *rufescens* but the collection also contains an exactly similar young bird of *gracilis* from Mt. Aboo where *rufescens* is not known to occur. Other juveniles of *gracilis* collected by Brooks in Maddapur (where also *rufescens* is not known to occur) agree with these birds, but lack the canary yellow wash though retaining rufous on the tail. It is evident that both species are very closely connected from the point of view of evolution and it is also significant that while in the Indo-Burmese countries the colour of the tails is an important aid to the separation of the two species, in the Indo-Chinese countries both species appear to retain a rufous tail in the adult winter plumage. At any rate that is the only hypothesis on which I can understand M. Delacour's and Mr. Steven's specimens.

During my examination of this species I found it necessary to examine the British Museum series of *Franklinia rufescens* (Blyth, J.A.S.B., xvi, May 1847, p. 456—Arakan) as in winter plumage these two species are often confused. It may be as well here to record the result of my examination.

This bird has in N.-E. India distinctive summer and winter plumages which are well described in the *New Fauna*, vol. ii, p. 427. It may be distinguished from *F. gracilis* by the following points:

F. gracilis.	*F. rufescens*
WINTER DRESS.	
Upper plumage duller, more olive in tint; tail definitely grey brown.	Upper plumage brighter, more fulvous; tail definitely bright fulvous.
Lower plumage pale fulvous white, warmer on breast and flanks, a greyish shade across breast.	Lower plumage fulvous, becoming pure white on throat and centre of abdomen.
SUMMER DRESS.	
Upper plumage and tail uniform leaden grey, the wings washed with dull chestnut.	Upper plumage fulvous brown, crown and nape leaden grey, wings washed with dull chestnut.
Lower plumage pale fulvous white, a leaden grey band across breast.	Lower plumage fulvous white, warmer on sides of breast and flanks.

F. rufescens generally has a heavier beak than *F. gracilis* and that of the former is said not to turn black in summer plumage.

I cannot, however, agree with Mr. Stuart Baker's treatment of Beavan's Wren-Warbler; he divides it into two forms. The typical race is said to be found in 'South India to the foot of the Himalayas; Burma south to Tenasserim, Yunnan, Siam and Annam'. *F. r. austeni*, described as differing in its darker colour and larger size, is said to occur form 'Kumaon to eastern Assam, North and South of the Brahmaputra, Manipur.'

Taken together the above distributions appear to mean that Beavan's Wren-Warbler is found throughout practically the whole of India. This is incorrect. I have seen no trustworthy evidence that it occurs anywhere in India except along the lower eastern Himalayas from Nepal (?—one Hodgson specimen which may have come from the eastern boundary of the kingdom) to the Duars, and thence through Assam into Burma etc. There are two races but in my opinion Mr. Stuart Baker has not correctly divided them. The type locality of *rufescens* is Arakan. The original description is short and inadequate but Mr. Kinnear has borrowed the type specimen from Calcutta and compared it with the two Arakan specimens (Oates) now in the British Museum with which it agrees. These two specimens agree with the type of *austeni* from Lhota, Naga Hills, and with them agree the Sikkim-Duars-Assam series. *Austeni* is therefore a synonym of *rufescens*.

Birds from Tenasserim and Malaya and Annam, however, differ from the series of *rufescens* in being slightly darker, more saturated in tint above, with less fulvous below. There is also far less difference in summer and winter dress, the winter dress approximating to that of summer, and *ipso facto* differing from the winter dress of the typical race in the contrast between crown and back and in the shorter tail. There is little difference in size between the races. except in the length of the tails in winter, 48-54 in *beavani* and 51-64 in *rufescens*. For this form there is already a name available viz. *Prinia beavani* Walden, P.Z.S., 1866 (November 22), p. 551, of which the type (♂ 10-8-65 Schouay Goon, Salween R., Beavan) is amongst the series in the British Museum. The Tenasserim race therefore may be known as *Franklinia rufescens beavani* (Walden).

Franklinia cinereocapilla (Horsf. and Moore) is a perfectly good species known to occur not only in Nepal, Sikkim and the Bhutan Duars, as stated in the *New Fauna*, but also as far west as Dhunda and Barahath (S.F., iii, p. 242). There seems to be very little known about the breeding of this species as in the *New Fauna* Mr. Stuart Baker can only describe one supposed nest and eggs. Apparently he has overlooked the fact that he described five nests and their eggs fully some years ago (J.B.N.H.S., ix, p. 15).

Franklinia buchanani (Blyth).

Prinia buchanani Blyth, J.A.S.B., xiii (1844), p. 376—Bengal.

[Jerdon states that the Rufous-fronted Wren-Warbler is found in the Carnatic and all through the tableland of south India. Old specimens labelled 'Madras' are in the British Museum. In spite of the above we feel that it is very doubtful whether this species occurs in the Presidency and it was not procured by the Survey.]

Schoenicola platyura (Jerdon).

Timalia platyura Jerdon, Madras Journ. Lit. Sci., vol. xiii (June 1844), p. 170—Goodalore in the Wynaad.

The Broad-tailed Grass-Warbler is confined in the Presidency to the western side. Jerdon obtained his type specimen, since lost, among some reeds in swampy ground close to Goodalore in the Wynaad at the foot of the Nilgiris. William Davison also reports that he saw it two or three times during his trip in the Wynaad, in the dense screw pine swamps. Mr. Betts informs me that he feels sure he has seen it several times at close range in the lemon grass and dwarf dates which cover the unforested slopes of the Nilgiris.

There are specimens in the British Museum (♂ 25-6-81, Palnis 5,000 ft.; ♂ 26-4-83 Pittur) obtained by Fairbank and Terry in the Palnis, but curiously enough neither author mentions them in their published accounts of those hills.

Further south it is evidently common in grass-lands on the summits of the hills in south Travancore, though according to Ferguson it does not occur either at Pirmeerd or on the High Range. A series of specimens from this area,—Calăthoorpolay Patnas 3,800-4,000 ft. (Bourdillon), Muthukaly (Ferguson), —are in the British Museum (see S.F., vii, 37; ix, 209-212 and J.B.N.H.S., xv, 457). Here Bourdillon considered that they were breeding in April. The *New Fauna* overlooks the occurrence of this bird in Ceylon.

Chaetornis striatus (Jerdon).

Megalurus? striatus Jerdon, Suppl. Cat. Birds (June) 1844, p. 169—Nilgiris.

The only records of the Bristled Grass-Warbler which I can trace for the Presidency are those of Jerdon, who states (B. of I., vol. ii, p. 72) that he first obtained it on the Nilgiris in swampy ground, but afterwards found it not rare at Nellore, during the cold season, in long grass and rice fields. These records probably refer to the four specimens from Jerdon in the British Museum, which are simply marked 'Madras' with no further data.

Phragamaticola aedon (Pallas).

Muscicapa aedon Pallas, Reise Russ. Reichs., vol. iii (1776), p. 695—Dauria.

Specimen collected:—1743 ♂ 29-4-30 Jeypore agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	18·5	82	85	26

The above specimen was the only one met by the Survey and was very fat, being evidently on migration. This is not the first record for the Presidency. Jerdon says that he first procured this species in the Carnatic near Nellore, and his specimen is still in the British Museum. Colonel Sparrow has kindly lent me a male in his collection, killed at Malappuram, S. Malabar, on 22 December 1912. Ferguson (J.B.N.H.S., xv, 457) says: 'I have only one specimen shot at the foot of the hills' in Travancore.

M. Stegman has recently divided this bird into two races, adding as a new race *Ph. ae. rufescens* Jour. f. O., lxxvii, pt. 2 (1929), p. 250—Amur. The material in the British Museum is not sufficient to allow me to appreciate the difference between the two races, but even if they are recognisable in their summer quarters the identification of specimens in winter appears problematical, for the plumage of this species differs greatly according to wear. Birds from Krasnoyarsk in worn breeding plumage are greenish olive brown on the upper parts, i.e. much the same colour as *Acrocephalus dumetorum*. A fresh moulted autumn specimen on the other hand is quite a rich fulvous brown.

Jerdon's specimen from Nellore is the type of his *Phragamaticola olivacca* ex Blyth MSS., Madras Jour. Lit. Sci., vol. xiii, pt. 2 (December 1844), p. 129. It agrees closely with the description of M. Stegman's *rufescens* and if two races are to be recognised Jerdon's name should doubtless be used for the Ussuri-Amur bird.

Hippolais rama rama (Sykes).

Sylvia rama Sykes, P.Z.S., 1832 (July 31), p. 89—Dukhun.

Specimens collected:—1097 ♂ 13-12-29, 1140 ♀ 19-12-29, 1159 ♂ 23-12-29 Cumbum Valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	14·5-15	61·5-63	51-55·5	19·5-21 mm.
1 ♀	15	58·5	49	20·5 mm.

Wing formula:—2=7/8 and 8/9.

There are not many records of Sykes' Tree-Warbler in the Presidency. William Davison mentions a specimen (♀) obtained by Miss Cockburn at Kotagherry on 14 October 1874 (S.F., x, 393) and this skin is still in the British Museum. It is a peculiarly worn and faded bird. Ferguson states that he only got one specimen in Travancore, at Cape Comorin in December 1901, but I have failed to discover it in the British Museum. On the eastern side we have only—in addition to the Survey specimens—Dewar's statement (J.B.N.H.S., xvi, 487) that hundreds of thousands visit Madras in the cold weather, their harsh 'chick chick' seeming to issue from almost every bush. This statement may be accepted with some reserve as Dewar's writings show that he is not very well acquainted with the various Warblers.

There appears to be no reason to treat the two forms *rama* and *scita* as species. In plumage and measurements they appear to be geographical races of one form, intermediates between them are certainly found, and we have seen no good evidence that both forms breed in one and the same area. The current statement that both birds breed in Kashmir is certainly incorrect, as there is no evidence at all that either do so.

Hippolais rama annectens of Sushkin (1925, p. 76, S. E. Altai) is somewhat of a mystery to workers who are unable to examine the Leningrad collections. We hazard a guess that this is the same as the intermediates between *rama* and *scita* that appear in India in winter.

Field workers in India find considerable difficulty in separating *rama* and *scita* and it certainly requires care. In fresh autumn and winter plumage they are very different in colour. In *rama* the upper plumage is then a uniform mouse grey brown, and the lower plumage is washed on the sides with the same colour. In *scita* the upper plumage is a darker and more fulvous brown. The wash on the lower plumage is fulvous brown and in addition is usually darker and more extensive than in *scita*. In spring plumage the difference is still appreciable but in autumn the adults usually arrive on migration in very worn breeding dress, and as these birds have no spring moult they are then terribly faded and ragged and the colour differences have practically disappeared. The majority, however, can still be separated by size. In 50 specimens (both sexes) of *rama* examined the beak measures 14.5-16.5, wing 58.5-66.5, tail 49-58 mm. In 40 specimens of *scita* bill 12.5-15, wing 57-65.5, tail 44-52.5 mm. In both birds the first primary is 3.5 to 10 mm. longer than the primary coverts, a point which allows of ready separation from *Acrocephalus dumetorum* and *agricola* with which they are often confused. In the two latter the first primary is minute, usually shorter than or equal to the primary coverts and never exceeding them by more than 3 mm. The stronger rictal bristles and the more graduated tails of the *Acrocephali* confirm the identification.

There is a male in the Colombo Museum, collected at Manaar N.P., Ceylon on 15 February 1905. It has not been previously recorded from the Island.

Hippolais rama scita (Eversmann).

Sylvia scita Eversmann, Add. Pallas. Zoogr. Rosso-Asiat., fasc., iii (1842), p. 12—Ural Mts.

Specimens collected:—1074 o? 9-12-29, 1094-5 ♂ ♀ 13-12-29, 1149 o? 21-12-29, 1161 ♀ 23-12-29 Cumbum Valley; 1278 ♂ 1282 ♀ 20-1-30, 1293 ♂ 1297 ♂ 23-1-30, 1305 ♀ 1309 ♂ 25-1-30, 1310 ♀ 1314 ♀ 26-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	13-14·5	59·5-65·5	47-50·5	18·5-20·5 mm.
6 ♀	12·5-14	58-65	46-52·5	19-21 mm.

Wing formula:—2=6/7 and 7/8.

The only previous record of the Booted Tree-Warbler in the Presidency is furnished by a specimen in the Hume Collection obtained at Coimbatore on 10-1-1873.

Sylvia hortensis jerdoni (Blyth).

Curruca jerdoni Blyth, J.A.S.B., vol. xvi (May 1847), p. 439—Southern India (Jaulnah).

The claim of the Eastern Orphean Warbler to a place in the Presidency list still rests on Jerdon's statement (B. of I., ii, 208) that he had seen it at

Trichinopoly, Madras and Nellore. It may well be commoner than this allows, as it is evidently not uncommon in Hyderabad.

Sylvia althaea Hume.

Sylvia althaea Hume, S.F., vol. vii (1878), p. 60—Jhansi.

There are only three specimens of Lesser White-throats in the British Museum from the Presidency, namely two birds marked simply 'Madras, Jerdon,' and one from the Hume Collection dated Coimbatore 10 January 1873. The first two are clearly specimens of Hume's Lesser White-throat with large bills 14 and 15 mm. respectively. The third may also belong to this form, but it is one of those intermediate specimens about which one cannot feel positive.

Jerdon's statement that he once found a White-throat very numerous in a hedgerow in the Carnatic and Dewar's record as 'fairly common' at Madras probably refer to this form.

Sylvia curruca blythi Ticehurst and Whistler.[1]

Sylvia curruca blythi Ticehurst and Whistler, Ibis 1933, p. 556—Cawnpore.

Specimen collected:—1350 ♀ 8-2-30 Anantagiri 3,000 ft.

Measurements:—

Bill.	Wing.	Tail.	Tarsus.
12	65	56	20·5 mm.

Wing formula:—2=7/8.

This was the only specimen of a Lesser White-throat collected by the Survey and I have failed to find any other definite record of this form within our area.

Phylloscopus affinis (Tickell).

Motacilla affinis Tickell, J.A.S.B., vol. ii (November 1833), p. 576—Borabhum.

Specimen collected:—1425 ♂ 22-2-30 Anantagiri 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	12	63·5	49·5	19·5 mm.

Tickell's Willow-Warbler is a very common winter visitor to the west of the Presidency, keeping apparently to the hills. In the Nilgiris, according to Davison, it is very numerous on the plateau and also on the slopes, from December to April. It is in winter somewhat social in habits, twenty or thirty collecting together, and most of its time is spent in low brushwood or feeding on the ground. William Davison gives an interesting account of its habits (S.F., x, 394) and a large series collected by him is in the British Museum.

In the Palnis it is apparently common at Pulungi, and a specimen collected by Fairbank as late as 3 April is in the British Museum. As regards Travancore we have only Ferguson's statement that he obtained it at 6,000 ft. in the High Range in winter.

The single specimen collected by the Survey provides the only record for the rest of the Presidency.

Phylloscopus tytleri Brooks.

Phylloscopus tytleri Brooks, P.A.S.B., 1871 (September), p. 210—Cashmere.

There are only two records of Tytler's Willow-Warbler in the Presidency. A male, now in the British Museum, was shot by William Davison at Ootacamund on 10 March 1881, and a second specimen was shot at the same place by the same collector on 22 January (1882 or 1883) vide S.F., x, p. 394.

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[1] For the change of name from *Sylvia c. affinis* Blyth see Ibis 1933, pp. 554-556.

Phylloscopus griseolus Blyth.

Phylloscopus griseolus Blyth, *J.A.S.B.*, vol. xvi (1847) p. 443—banks of the Hoogly.

[Jerdon informs us (*Madras Journ. Lit. Sci.* vol. xiii, (1844), p. 131 that he obtained this species 'from the range of the Eastern Ghats'. As Mr. Salim Ali obtained it at Nelipaka and Asifabad, both in Hyderabad State, and Mr. D'Abreu obtained it at Parasgaon, Bastar on 24-1-14 its occurrence in the Eastern Ghats is far from improbable, but until we have a more definite record the Olive Willow-Wren can hardly be admitted to a full place on the Madras Presidency list.]

Phylloscopus inornatus humei Brooks.

Reguloides humei Brooks, S.F., vii (1878). p. 131—North-west India, restricted to Srinagar (Stuart Baker, *New Fauna*, vol. ii, p. 469).

Specimens collected:—1333 ♂ 6-2-30 Anantagiri 3,000 ft.; 1524 ♀ 12-3-30 Sankrametta 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	10·5	61	43	17·5 mm.
1 ♀	10	55	39·5	17 mm.

Wing formula:—2=7/8 and 9/10.

Both the above specimens are in rather worn plumage, but after careful examination I am of opinion that they belong to this race.

In the *New Fauna* (vol. ii, p. 469), Hume's Yellow-Browed Warbler is said to occur in winter south to the greater part of western India as far south as Travancore. My own researches, however, confirm Oates' opinion (*Old Fauna*, vol. i, p. 411) that it occurs on this side only as far south as Belgaum. With the somewhat doubtful exception of Jerdon's statement (B. of I., ii, 197) that he had obtained it at Nellore, the above specimens furnish the only authentic record of this species in the Presidency. It must be of course only a winter visitor.

Phylloscopus nitidus nitidus

Phylloscopus nitidus Blyth, J.A.S.B., vol. xii (after 13 November 1843), p. 965—near Calcutta.

Specimens collected:—13 ♀ 10-4-29 Kurumbapatti; 862 ♂ 2-10-29 Seshachalam Hills 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	12·5	65·5	49·5	19 mm.
♀	13	60·5	43·5	18·5 mm.

Wing formula:—2=6/7.

The Green Willow-Warbler is either not very common or else little noticed in the Presidency where it must be a winter visitor or a passage migrant on its way to Ceylon. On the eastern side the above specimens provide the only records, save for Jerdon's statement (Madras Jour. Lit. Sc., xiii, p. 131) that he had obtained it at Nellore.

On the west, William Davison procured a male (now in the British Museum) at Manantoddy, Wynaad, on 10-4-1881, remarking that he saw several others in the course of that trip.

In Travancore, Bourdillon considered it common in heavy jungle (S.F., iv, 401). Ferguson expands this to a winter visitor to the plains and hills throughout. He adds that it is possible that some birds remain throughout the summer as he had two specimens shot at 4,000 ft. in July. The only Travancore specimen in the British Museum is an undated bird from Mynall (Bourdillon).

Phylloscopus nitidus viridanus Blyth.

Phylloscopus viridanus Blyth, J.A.S.B., xii (after 13 November 1843), p. 967 —near Calcutta.

Specimens collected:—13 ♀ 10-4-29, 76 ♂ 17-4-29, 161 ♀ 1-5-29 Kurumbapatti; 972 o? 4-11-29, 989 ♂ 9-11-29 Nallamallai range 2,000 ft.; 1326 ♂ 5-2-30, 1428 o? 22-2-30 Anantagiri 3,000 ft.; 1460 ♂ 2-3-30, 1487 o? 6-3-30 Sankrametta 3,500 ft.; 1723 ♀ 24-4-30, 1742 ♀ 29-4-30 Jeypore agency 2,000-3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	12-13	59·5-64·5	47-49	18-19·5 mm.
4 ♀	12-13	59-62	43·5-47·5	18-19 mm.

Wing formula:—2=6/7, 7/8 or 8.

The Greenish Willow-Warbler is evidently a common winter visitor (and also no doubt passage migrant through to Ceylon) in the Presidency, though the above specimens provide the only authentic records for the eastern side. The Kurumbapatti birds were very fat. On the west William Davison tells us that it is the common Willow-Wren of the Wynaad and Nilgiris arriving early and staying as late as the first week of April. This is substantiated by specimens in the British Museum and in my own collection, of which the earliest and latest dates are 18 September and 5 April.

I have seen no specimens from Travancore, but Ferguson says that it is a fairly common winter visitor throughout the hills, most common at an elevation of 2,000 ft. to 3,000 ft. but occurring also in the High Range and in the low country.

Phylloscopus magnirostris Blyth.

Phylloscopus magnirostris Blyth, J.A.S.B., vol. xii (after 13th Nov. 1843), p. 966—near Calcutta.

Specimen collected:—875 ♀ 4-10-29 Seshachalam Hills 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♀	—	67	49	19 mm.

Wing formula 2=7/8.

The Large-billed Willow-Warbler has not very often been recorded in the Presidency. On the eastern side, in addition to the above Survey specimen, we have only Jerdon's statement that he obtained it at Nellore in the cold weather.

On the western side, William Davison obtained a specimen (now in the British Museum) at Manantoddy, Wynaad, on 18th May 1881. A specimen collected by Bourdillon at Mynall on 15-11-1874 is in the British Museum and he considered it 'less abundant' in Travancore than *Phylloscopus nitidus*. Ferugson, however, considered it 'probably rare,' as he had only seen two specimens at the summit of the hills.

Phylloscopus trochiloides ludlowi Whistler [=*lugubris* auct.].

Phylloscopus trochiloides ludlowi Whistler, Bull. B.O.C., vol. liii, no. ccclv (9 December, 1931) p. 62—Maran River 5,500 ft., two stages from Kishtwar.

Specimens collected:—1531 ♀ 13-3-30, 1627 o? 30-3-30 Sankrametta 3,000 ft.; 1732 ♂ 27-4-30 Jeypore Agency 3,000 ft.; 1765 ♂ 4-5-30 Anantagiri 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	13-13·5	62·5-64·5	51·5-52	20-21 mm.
1 ♀	12	56	46	19·5 mm.

Wing formula:—8/9, 9/10, 10/11.

The only previous record of the Dull-green Willow-Warbler in the Presidency is that of Jerdon (B. of I., ii, 192) who states that he procured it in the Nilgiris, in the Wynaad and also at Nellore. This record has previously been described in both editions of the *Fauna* in view of the necessary confusion on the older writers on the subject of this difficult group and the absence of any specimens in the Hume collection from anywhere in Peninsular India. It now seems more likely that Jerdon was correct. Two of the above specimens were in moult and individuals of the eastern and western races are hard to distinguish, but after careful comparison I am of opinion that the Survey specimens[1] belong to the western race.

Phylloscopus occipitalis occipitalis (Blyth).

Phylloscopus occipitalis Blyth, J.A.S.B., vol. xiv (after August 1845) p. 593—South India [=Nellore].

Specimens collected:—54 ♂ 15-4-29 Kurumbapatti; 987 ♂ 9-11-29 Nallamallai range 2,000 ft.; 1426 ♂, 22-2-30, 1430 ♂ 1439 o? 25-2-30 Anantagiri 3,000 ft.; 1649 ♂ 3-4-30 Sankrametta 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	13·5-14	59·5-69·5	45·5-52	16·5-19 mm.

Wing formula:—2=6/7, 7, 7/8 and 8/9.

The Large-Crowned Willow-Wren is evidently a winter visitor to the Madras Presidency, though we have not a great deal of information about it. On the eastern side, beyond the fact that Jerdon obtained the type specimen at Nellore in the cold weather (Madras Journ. Lit. Sci., xiii., p. 131) the Survey specimens furnish the only records. The Kurumbapatti bird was very fat and evidently about to migrate.

On the western side the bird is only reported from Travancore. There Ferguson says it is not uncommon in the winter months at high elevations in the hills, going about in small parties.

Seicerus burkii whistleri Ticehurst.

Seicercus burkii whistleri Ticehurst, Bull. B.O.C., vol. xlvi (1925), p. 22—Dharmsala.

Specimen obtained:—1466 ♀ 3-3-30 Sankrametta.

Measurements:—

Bill.	Wing.	Tail.	Tarsus.
13	54·5	43	18 mm.

The single specimen of the Black-browed Flycatcher-Warbler was shot in very dense forest. It furnishes the sole record for the species and race in the Presidency and is a slight extension southwards of the known distribution of this species in winter. After careful comparison I consider that the specimen belongs to the western race and the migration of this form is no doubt south-easterly in direction as with several other west-Himalayan birds.

Homochlamys pallidipes pallidipes (Blanford).

Phylloscopus pallidipes Blanford, J.A.S.B., vol. xli (June 1872), p. 162—Sikkim.

Specimen collected:—1677 ♂ 12-4-30 Sankrametta 3,500 ft.

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[1] Since the above was written the Director of the Colombo Museum has kindly allowed me to examine the series of Warblers under his charge. Amongst them I have found a specimen of *P. t. trochiloides* ♀ 21-10-1921 from Matara, S.P., Ceylon. This species is previously unrecorded from the island.

Measurements:—

Bill.	Wing.	Tail.	Tarsus.
Damaged	55	45	19·5 mm.

The discovery of Blanford's Bush-Warbler in the Vizagapatam ghats was one of the surprises of the Survey. Only the one specimen was obtained but the testes were distinctly enlarged and it would be interesting to know more about the species in this area. In any case the range in India as given in the *New Fauna*, vol. ii, p. 509—Sikkim to Eastern Assam—must be considerably extended, as B. B. Osmaston has already recorded (J.B.N.H.S., xxvi, p. 426) that it occurs as far west as Dehra Dun. This specimen agrees with topotypes.

Prinia socialis socialis Sykes.

Prinia socialis Sykes, P.Z.S. 1832 (April) p. 89—Dukhun.

Specimens collected:—64 o? 16-4-29, 136 ♂ 26-4-1929, 145 ♂ 147 ♀ 28-4-29 Kurumbapatti; 1515 ♀ 10-3-30, 1522 ♂ 12-3-30, 1577 ♂ 22-3-30, 1647 ♀ 3-4-30 Sankrametta 3,000 ft.; 1709-1710 ♂ ♂ 20-4-30 Jeypore Agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
6 ♂	13·5-15	45-53	59-64	19-21·5 mm.
3 ♀	13-14·5	45-47	55	19·5-20·5 mm.

The Ashy Wren-Warbler is evidently widely distributed and common in the Presidency but as in the case of so many other common species we are unable to trace its distribution very accurately. Specimens were only procured by the Survey in the Vizagapatam hills and at Kurumbapatti, and to bridge this wide gulf on the eastern side we have only Jerdon's general statements that it occurs in the Carnatic and throughout southern India, and Dewar's more particular statement that at Madras it is not very abundant.

It is apparently commoner on the west, though in Coorg, according to Betts it is scarce. In the Nilgiris it is one of the most familiar and common Warblers, occurring at all elevations on the slopes, but being most common above 5,000 ft. In the Palnis it seems to be found similarly at all elevations, and that would seem to be the case also in Travancore. At any rate Ferguson and Bourdillon between them found it common both in the low country and in the grasslands of Pirmeerd and the High Range. Everywhere in its range this Warbler avoids heavy jungle.

William Davison (N. & E., i, 292) tells us that in the Nilgiris the breeding season is March, April and May and sometimes as late as the earlier part of June. Miss Cockburn at Kotagherry considered the breeding season June and July. In Travancore, Bourdillon says they breed on the lower slopes of the hills in May and June and also in July.

The *New Fauna* does not seem to us very happy in its treatment of this species. In volume ii, the author divides it into two races—*P. s. socialis* of Sykes (type locality Deccan) and *P. s. stewarti* (type locality Agra) and states that the only difference between the two forms lies in the richer colour of the lower parts of the latter bird. In vol. vii, p. 201, the type locality for the typical form is changed to Sikkim, with no word of explanation, though this change, if correct, gives both the northern and southern forms type localities in the north.

This Wren-Warbler, like others, undergoes a complete spring and a complete autumn moult, the former about April-May, the latter about October-November. It is important to consider these two plumages separately, as their variation is of racial importance, a point which is overlooked by the *New Fauna* where the winter plumage of *P. s. stewarti* is described under *P. s. socialis*.

In North-West India the difference between the summer and winter plumage is very distinct. In summer the upper parts are a dark uniform slaty ash-colour with the rump and upper tail coverts rufous brown. In winter the upper plumage is rufous brown throughout, sometimes very bright, washed with slaty ash-colour on the crown and nape; the tail is then much longer.

In Southern India, on the other hand, there is very little difference between the two plumages. The summer plumage agrees with the summer plumage of the north-west, but the slaty ash-colour extends to the rump and upper tail coverts and the wings and tail are darker, more saturated in colour. The winter plumage only differs from the summer in a faint olive wash on the back, not always noticeable in worn plumage. The difference in length of tail is not nearly so great.

There is of course intergrading between the two extremes and it is unfortunate that Sykes' type locality lies in the intermediate area. It is, however, safe to assign his name to the southern form.

This intergrading is also illustrated by the Vizagapatam series which in the amount of rufous wash on the upper parts show a slight approach to the winter plumage of the northern form.

Two more races must, however, be recognised. The first is the insular race in Ceylon for which there is already a valid name

Prinia socialis brevicauda Legge.

Prinia brevicauda Legge, *Birds of Ceylon* (1878), p. 521—Ceylon.

This agrees with the typical race in having the summer and winter plumage alike. It is however slightly smaller with a shorter tail. A large series (sexing indifferent but both sexes included) measures:—

Bill.	Wing.	Tail.
14-15	43-49 (once 51)	42-54 mm.

The second race is found in the Duars, N. Khasia Hills and Darrang. Of this race no specimens in summer plumage have been examined, but a large series in winter plumage are very distinct indeed from *P. s. stewarti*. They have not the bright rufous winter plumage of that form but are ashy blue grey above as in the southern typical form. They differ from that, however, in the much darker, more saturated upper parts, the deeper rufous of the flanks, and the finer and shorter beak. This is, therefore, another of the perfectly good 'saturated Duars races' and in the absence of an applicable existing name, I propose to name it after Mr. Charles M. Inglis, to whom I am indebted for much fine material from the Duars:—

Primia socialis inglisi subsp. nov.

Type. January 1876 Bhutan Duars (Mandelli), British Museum Register No. 1886, 10-1-1660.

Prinia sylvatica sylvatica Jerdon.

Prinia sylvatica Jerdon, Madras Jour. Lit. Sci., vol. xi (January 1840), p. 4—Seegore Pass of the Nilgiris.

Specimens collected:—87 ♂ 19-4-29 Kurumbapatti; 638 ♂ 2-8-29, 653 ♂ 5-8-29, 675 ♂ 10-8-29, 693 ♂ 700 ♂ 15-8-29, 721 ♂ 21-8-29, 730 ♂ 22-8-29, 740 ♂ 24-8-29, 769 ♀ 28-8-29 Palkonda Hills 1,000 ft.; 851 ♂ juv 30-9-29, 864 [♂] 3-10-29, 874 ♂ 4-10-29, 887 ♂ 7-10-29, 923 ♂ 14-10-29 Seshachalam Hills 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
12 ♂	(13) 14-15	56-63·5	65-72·5	21·5-24·5 mm.
2 ♀	13·5-14	51·5-54	56-56·5	20·5-21·5 mm.

Our precise knowledge of the Jungle Wren-Warbler in the Presidency is largely confined to what we have learnt from the Survey. In spite of the implication in both editions of the *Fauna* that the species occurs throughout southern India we can trace no record of it on the western side of the Presidency, beyond Jerdon's original statement: 'I have only seen this species hitherto in open forest jungle in the Seegore Pass of the Nilgiris'. The type is lost and the bird has not since been recorded from this area, but we think that there can be no doubt that Jerdon was really describing the Jungle Wren-Warbler, as later generations have known it, for the measurements, wing $2\frac{1}{10}$ inches (=61 mm.) and tail $2\frac{7}{10}$ inches (=69 mm.), are too large for any other Indian species of the genus.

Jerdon's own account of the distribution of *sylvaticus* (B. of I., ii, p. 181) is that it is 'only found in southern India, in low jungle in the Carnatic, in thin tree jungle on the Eastern Ghats and in the more open parts of the forest on the Malabar coast, ranging up the slopes of the Neilgherries to 4,000 ft.' He must also have found it in 'the jungles skirting the base of the Eastern Ghats' as he includes this in the range of his second form *neglectus*.

The Survey obtained it at Kurumbapatti and found it very common in the Palkonda and Seshachalam Hills. Jerdon's record of a nest at Nellore and Mr. Hasted's record for S. Arcot district (Inglis, p. 86) and a male in the British Museum, collected by Blanford on 27 March 1871 near Ellore, conclude the records for the Presidency.

There has been a great deal of confusion in the past over this large Wren-Warbler, and the author of the *New Fauna* in suggesting the existence of a grey race at Mount Aboo has overlooked Hume's final and correct pronouncement (S.F., vii, pp. 217-218) that his *rufescens* and *insignis* were the winter and summer plumages respectively of one and the same species. There are seven specimens from Mount Aboo in the British Museum. Six of these are in summer plumage and grey. The seventh is in winter plumage and fulvous. They agree, thereby, with all other specimens from the north of the Peninsula, a point sufficiently indicated by Hume in his original descriptions, and there is no ground whatever for separation of a Mount Aboo race as such. There are, however, two races in India and a third in Ceylon and they agree with other Wren-Warblers in the importance which needs to be attached to the evolution of the summer and winter plumages. In this the tail changes, which Mr. Stuart Baker has disregarded, though they were indicated in the *Old Fauna*, are of the highest importance.

As with many other Wren-Warblers, this species has attained its highest stage of evolution in north-west India. Here the summer and winter plumages are very different. The summer plumage is meticulously described by Hume as *Drymoipus insignis* (S.F., i, (1872), p. 10). We may summarise it here as having the upper parts grey-brown in tint, and much white on the lateral tail feathers. The winter plumage is described with equal care by Hume as *Drymoepus rufescens* (*Ibis* 1872, p. 110). This is ruddy fulvous in tint and the white disappears from the lateral tail feathers. It will be remembered of course that the post-nuptial moult is very late, from October to December.

For this race there is an earlier name than Hume's, viz., *Suya gangetica* Blyth, *Ibis*, 1867, p. 23—Upper Ganges. The description is very poor, but the measurements (wing 2.25 ins. =57 mm.: tail 3.75 ins. =95 mm.) and the presence of the type in the British Museum shows clearly that the Jungle Wren-Warbler is meant.

In the Ceylon bird, the summer and winter plumage is always alike, the tail being of the winter type referred to above, without white on the lateral tail feathers. The colour is a richer darker brown above than all continental birds,—darker even than Brookes' Muddapur series, which suggest that if the distribution extended further north-east another 'saturated' race would be developed in the Duars—and below a warmer, more yellowish fulvous. This is correlated with a breeding season that lasts the year round, as explained by Mr. Stuart Baker, Bull. B.O.C., vol. xl, no. ccl, p. 112. The correct name for the Ceylon bird is *Prinia sylvatica valida* (Blyth).

The typical race from southern India—Hyderabad, Mysore and Madras Presidency—lies between these extremes. In summer and winter the colour shows little variation and agrees with the summer plumage of the northern race. Only a proportion of the summer birds develop the white lateral tail feathers, and I cannot yet make out whether this is due to dimorphism or a less regular spring moult than in the north.

Prinia inornata inornata Sykes.

Specimens collected:—162 ♀ 1-5-29 Kurumbapatti; 447 ♂ 19-6-29 Harur 1,000 ft.; 470 [♂] 23-6-29 Tirthamalai; 482 ♀ juv. 2-7-29 Trichinopoly; 497 ♂ 3-7-29 Kalai, Trichinopoly; 575 ♀ 21-7-29 Gingee; 815 ♂ 13-9-29 Kodur; 1292 ♂ 23-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail (summer).	Tail (winter).	Tarsus.
5 ♂	13-14	47·5-51	48·5-53	53·5	18·5-20 mm.
2 ♀	12-13	45·5-48·5	51	...	19-19·5 mm.

There is surprisingly little information on record about the Indian Wren-Warbler in the Presidency; in fact beyond general statements that the bird occurs all over India the above specimens provide the only authentic evidence of the occurrence of the typical race within our limits.

There is probably no species which has given us more trouble to work out in the Survey than this common and well-known bird, partly because of the racial importance of the relationship between the summer and winter plumages and partly because of the difficulties of the synonomy. The Indian Wren-Warbler agrees with the other two preceding species in having summer and winter plumages alike in the extreme south and markedly different in size and length of tail in the north; but as its range is greater than that of both the Jungle Wren-Warbler and the Ashy Wren-Warbler it has developed a larger number of races, of which the typical form is really the intermediate between the others.

The summer and winter plumages are each preceded by a complete moult, from March to May and July to November respectively, individual birds of course not taking the whole of these periods. There is, however, to add to the difficulties some irregularity about the incidence of the moults, actual breeding birds being sometimes found in moult or in winter dress whilst the juvenile plumage is in character and colour somewhat between the adult summer and winter plumages. The normal difference between the summer and winter plumages is as follows.

In winter plumage the upper parts are strongly rufescent, the lower parts warm buff; the wings are hair brown, margined with dull ferruginous. The tail is long and deeply graduated, rufescent brown, all the tail feathers much the same colour with an imperfect subterminal dark bar and a pale tip. The bill is brown, with the greater part of the lower mandible yellowish horny.

In summer plumage the upper parts are dull earthy grey-brown, the lower parts white with a faint yellowish tinge; the wings are earthy brown, margined albescent. The tail is shorter and less graduated than in winter. The central feathers are pale earthy brown, but the lateral feathers grow paler towards the external pair which is almost white. The subterminal dark bar and pale tip is usually absent from the central feathers. The bill is black, yellowish at the extreme base of the lower mandible.

These differences are easily appreciated in the birds of peninsula and northern India, whence I have been able to examine a very good series from the British Museum and other private sources. From north-east India, south-west India and Ceylon the series available is far from sufficient to indicate the plumage changes beyond possibility of error, but I am fairly satisfied that in north-east India the changes are similar, and that in Ceylon summer and winter plumages are alike. As regards south-west India the position is obscure. It is, however, quite clear that we must recognise four races in India, apart from the Ceylon and Burmese races.

It is not surprising therefore that in the last hundred years a variety of names have been given to the members of the genera of *Prinia* and *Franklinia* in India. Authors have happened individually on subspecific and seasonal differences, have failed to understand them for lack of material and in naming them have often failed to give an adequate diagnosis. The result is that these names have later been wrongly applied, sometimes to even the wrong species. We have therefore had to assemble first of all original descriptions of a large number of names, fix the species, race and stage to which each applies and then fix the prior name for each race. Such types as are noted as being in the British Museum we have examined. This has entailed a very considerable amount of work and as it may prove of interest and value to other workers we append hereto a table showing the priority of publication of the various names with our identifications of them. A few referring to the more distinct species, which cannot be in doubt, have been omitted. Luckily there is no doubt about the specific name of each species. With these remarks I detail the following races of *Prinia inornata* recognised in India and Ceylon.

Prinia inornata inornata Sykes.

Prinia inornata Sykes, P.Z.S. 1832 (July 31) p. 89—Dukkun. Central and Southern India, excluding the range of *P. i. franklinii.*

	Bill.	Wing.	Winter tail.	Summer tail.
23 ♂	12-14	46·5-54·5	53·5-70·5	48·5-55 mm.

Prinia inornata terricolor (Hume).

Drymoipus terricolor Hume, *N. and E. of Indian Birds* (1874) p. 349—N. W. India = Oudh, Agra.

N.W. Fronties Province, Punjab, Sindh, United Provinces. Exact boundary between this and the typical form, not yet known.

Paler and brighter in colour; tail more uniform in colour, the subterminal dark bar usually almost obsolete; tail much longer in winter.

	Bill.	Wing.	Winter tail.	Summer tail.
15 ♂	12·5-14·5	47·5-54	69-84·5	48·5-56 mm.

Prinia inornata fusca (Hodgson).

Drymoica fusca Hodgson, P.ZS., 1845 (August) p. 29—Nepal.

Nepal and Sikkim Terai, Bhutan Duars, Upper Assam.

Darker and more saturated in colour than the typical form with a more pronounced fulvous wash below; tail longer in winter as in *P. i. terricolor.* (No proper summer series available).

	Bill.	Wing.	Winter tail.
13 ♂	13·5-14·5	49-52	66·5-87 mm.

Prinia inornata franklinii Blyth.

Prinia franklinii Blyth, J.A.S.B., 1844 (after May), p. 376—no locality [S. India]—now restricted to Nilgiris.

Nilgiris and Palnis; probably also Travancore ranges.

Larger, Darker and browner than the typical form, with tail markings much more distinct. (No proper summer series available and relationship between summer and winter plumage obscure.)

	Bill.	Wing.	Winter tail.
7 ♂	13-14	52-55	58·5-70·5 mm.

Prinia inornata insularis (Legge).

Drymoeca insularis Legge, *Birds of Ceylon* (*September* 1879), p. 529—Ceylon.

Colour as in last form but much longer beak. Summer and winter plumage apparently alike with no difference in length of tail.

	Bill.	Wing.	Tail.
10 ♂	14-16	50-54	54·5-58 mm.

CHRONOLOGICAL TABLE OF NAMES APPLIED TO INDIAN WREN-WARBLERS.

Date of Publication	Name, Reference, type locality and type	Identification and Notes
25 Oct. 1831	✓ *Prinia macroura* Franklin, P.Z.S. 1830-1831, p. 118—Ganges between Calcutta and Benares and in the Vindhyian Hills between the latter place and Gurra Mandela, on the Nerbudda. Type certainly lost.	Preoccupied by *Prinia* (*Motacilla*) *macroura* (Gmelin.) Syst. Nat. (1788), i, p. 953=*Prinia maculosa* Bodd. Evidently the winter plumage of *Prinia inornata terricolor* (Hume).
do.	✓ *Prinia gracilis* Franklin, P.Z.S. 1830-1831, p. 119—Ganges etc. as above. Type certainly lost.	*Franklinia gracilis* (Franklin) (winter plumage).
31 July 1832	✓ *Prinia socialis* Sykes, P.Z.S. 1832, p. 89 (No. 78)—Dukhun. Types: 4 specimens in British Museum, Reg. Nos. 80.1.1.3062 et 3019 et 3017 et 1213.	*Prinia socialis socialis* Sykes. The Deccan is strictly speaking an intermediate area but the specimens are habitually and rightly grouped with the South Indian form.
do.	✓ *Prinia inornata* Sykes, P.Z.S. 1832, p. 89 (No. 79)—Dukhun. Type in British Museum, Reg. No. 1880. 1.1.3005 (another specimen lost).	*Prinia inornata inornata* Sykes (winter plumage).
After 30 Nov. 1833	✓ *Sylvia longicaudata* Tickell, J.A.S.B., vol. ii, p. 576—Jungles of Borabhum and Dholbhum. Type lost.	*Prinia inornata inornata* Sykes (winter plumage).
After 7 May 1840	✓ *Prinia sylvatica* Jerdon, Madras Jour. Lit. Sci., vol. xi, p. 4 (No. 120)—Segore Pass of the Neilgherries. Type probably lost.	*Prinia sylvatica sylvatica* Jerdon.
do.	✓ *Prinia rufifrons* Jerdon, Madras Jour. Lit. Sci., vol. xi, p. 4 (No. 121)—Neighbourhood of Jaulnah. Type probably lost.	Preoccupied by *Prinia rufifrons* Ruppell. *Franklinia buchanani* (Blyth).
After May 1844	✓ *Sylvia kalaphutki* Blyth, J.A.S.B., vol. xiii, p. 376—Bengal.	*Prinia socialis* Sykes. From Buchanan Hamilton's drawings; may be regarded (either as a *nomen nudum* or better as a synonym of *P. s. socialis*).

do.	*Prinia franklinii* Blyth, J.A.S.B., xiii, p. 376—no locality [S. India]. *Note.*—It is very doubtful whether the type of this can now be traced.	*Prinia inornata franklinii* Blyth. Regarded by Blyth as the same species as *Prinia macroura* Franklin preoccupied but based on a description quoted from Jerdon with the comment *non vidi*. Must therefore be taken as 'South India' and is now restricted to the Nilgiris to avoid the creation of a new name for the Nilgiri race of *Prinia inornata* to which the name *Drymoica jerdoni* Blyth [=*P. s. sylvatica*] has hitherto been erroneously applied.
do.	*Prinia buchanani* Blyth, J.A.S.B., xiii, p. 376—Southern India=Jaulnah. Type in Indian Museum, Calcutta. Specimen A. S. India T. C. Jerdon, Esq., 1842.	*Franklinia buchanani* (Blyth). New name for *Prinia rufifrons* Jerdon preoccupied.
do.	*Prinia hodgsonii* Blyth, J.A.S.B., xiii, p. 376—Nepal.	*Franklinia gracilis* (Franklin).
do.	*Prinia lepida* Blyth, J.A.S.B., xiii, p. 376—Indus territories. Type in Indian Museum, Calcutta. Specimen D. Scinde, Sir A. Burnes, 1841.	*Prinia gracilis lepida* (Blyth).
After Nov. 1844	*Prinia neglecta* Jerdon, Madras Jour. Lit. Sci., vol. xiii (1844, after November), p. 130—Jungle skirting the base of the Eastern Ghats.	*Prinia sylvatica sylvatica* Jerdon.
Aug. 1845	*Drymoica fusca* Hodgson, P.Z.S. 1845, p. 29—Nepal.	*Prinia inornata fusca* (Hodgson).
After May 1847	*Prinia stewarti* Blyth, J.A.S.B., xvi, p. 455—Agra.	*Prinia socialis stewarti* (Blyth).
do.	*Prinia rufescens* Blyth, J.A.S.B., xvi, p. 456—Arrakan. Type in Indian Museum, Calcutta (Capt. Phayre 1846).	*Franklinia rufescens rufescens* (Blyth).
do.	*Drymoica jerdoni* Blyth, J.A.S.B., xvi, p. 459—S. India.	*Prinia sylvatica sylvatica* ♀. The sexes differ markedly in size in this Wren-Warbler.
do.	*Drymoica sericea* Blyth, J.A.S.B., xvi, p. 460—S. India.	*Prinia inornata inornata* Sykes. Juvenile plumage.
After Aug. 1849	*Drymoica robusta* Blyth, J.A.S.B., xviii, p. 812—No locality [From Layard, Ceylon].	Preoccupied by *Drymoica robusta* Ruppell. *Prinia sylvatica valida* (Blyth).
After 5 May 1851	*Drymoica valida* Blyth, J.A.S.B., xx, p. 180—No locality [Ceylon].	*Prinia sylvatica valida* (Blyth). New name for *Drymoica robusta* Blyth, preoccupied.

CHRONOLOGICAL TABLE OF NAMES APPLIED TO INDIAN WREN-WARBLERS.

Date of Publication	Name, Reference, type locality and type	Identification and Notes
25 Oct. 1831	✓ *Prinia macroura* Franklin, P.Z.S. 1830-1831, p. 118—Ganges between Calcutta and Benares and in the Vindhyian Hills between the latter place and Gurra Mandela, on the Nerbudda. Type certainly lost.	Preoccupied by *Prinia* (*Motacilla*) *macroura* (Gmelin.) Syst. Nat. (1788), i, p. 953 = *Prinia maculosa* Bodd. Evidently the winter plumage of *Prinia inornata terricolor* (Hume).
do.	✓ *Prinia gracilis* Franklin, P.Z.S. 1830-1831, p. 119—Ganges etc. as above. Type certainly lost.	*Franklinia gracilis* (Franklin) (winter plumage).
31 July 1832	✓ *Prinia socialis* Sykes, P.Z.S. 1832, p. 89 (No. 78)—Dukhun. Types: 4 specimens in British Museum, Reg. Nos. 80.1.1.3062 et 3019 et 3017 et 1213.	*Prinia socialis socialis* Sykes. The Deccan is strictly speaking an intermediate area but the specimens are habitually and rightly grouped with the South Indian form.
do.	✓ *Prinia inornata* Sykes, P.Z.S. 1832, p. 89 (No. 79)—Dukhun. Type in British Museum, Reg. No. 1880. 1.1.3005 (another specimen lost).	*Prinia inornata inornata* Sykes (winter plumage).
After 30 Nov. 1833	✓ *Sylvia longicaudata* Tickell, J.A.S.B., vol. ii, p. 576—Jungles of Borabhum and Dholbhum. Type lost.	*Prinia inornata inornata* Sykes (winter plumage).
After 7 May 1840	✓ *Prinia sylvatica* Jerdon, Madras Jour. Lit. Sci., vol. xi, p. 4 (No. 120)—Segore Pass of the Neilgherries. Type probably lost.	*Prinia sylvatica sylvatica* Jerdon.
do.	✓ *Prinia rufifrons* Jerdon, Madras Jour. Lit. Sci., vol. xi, p. 4 (No. 121)—Neighbourhood of Jaulnah. Type probably lost.	Preoccupied by *Prinia rufifrons* Ruppell. *Franklinia buchanani* (Blyth).
After May 1844	✓ *Sylvia kalaphutki* Blyth, J.A.S.B., vol. xiii, p. 376—Bengal.	*Prinia socialis* Sykes. From Buchanan Hamilton's drawings; may be regarded (either as a *nomen nudum* or better as a synonym of *P. s. socialis*).
do.	✓ *Prinia franklinii* Blyth, J.A.S.B., xiii, p. 376—no locality [S. India]. *Note.*—It is very doubtful whether the type of this can now be traced.	*Prinia inornata franklinii* Blyth. Regarded by Blyth as the same species as *Prinia macroura* Franklin preoccupied but based on a description quoted from Jerdon with the comment *non vidi*. Must therefore be taken as 'South India' and is now restricted to the Nilgiris to avoid the creation of a new name for the Nilgiri race of *Prinia inornata* to which the name *Drymoica jerdoni* Blyth [= *P. s. sylvatica*] has hitherto been erroneously applied.
do.	✓ *Prinia buchanani* Blyth, J.A.S.B., xiii, p. 376—Southern India = Jaulnah. Type in Indian Museum, Calcutta. Specimen A. S. India T. C. Jerdon, Esq., 1842.	*Franklinia buchanani* (Blyth). New name for *Prinia rufifrons* Jerdon preoccupied.
do.	✓ *Prinia hodgsonii* Blyth, J.A.S.B., xiii, p. 376—Nepal.	*Franklinia gracilis* (Franklin).
do.	✓ *Prinia lepida* Blyth, J.A.S.B., xiii, p. 376—Indus territories. Type in Indian Museum, Calcutta. Specimen D. Scinde, Sir A. Burnes, 1841.	*Prinia gracilis lepida* (Blyth).
After Nov. 1844	✓ *Prinia neglecta* Jerdon, Madras Jour. Lit. Sci., vol. xiii (1844, after November), p. 130—Jungle skirting the base of the Eastern Ghats.	*Prinia sylvatica sylvatica* Jerdon.
Aug. 1845	✓ *Drymoica fusca* Hodgson, P.Z.S. 1845, p. 29—Nepal.	*Prinia inornata fusca* (Hodgson).
After May 1847	✓ *Prinia stewarti* Blyth, J.A.S.B., xvi, p. 455—Agra.	*Prinia socialis stewarti* (Blyth).
do.	✓ *Prinia rufescens* Blyth, J.A.S.B., xvi, p. 456—Arrakan. Type in Indian Museum, Calcutta (Capt. Phayre 1846).	*Franklinia rufescens rufescens* (Blyth).
do.	✓ *Drymoica jerdoni* Blyth, J.A.S.B., xvi, p. 459—S. India.	*Prinia sylvatica sylvatica* ♀. The sexes differ markedly in size in this Wren-Warbler.
do.	✓ *Drymoica sericea* Blyth, J.A.S.B., xvi, p. 460—S. India.	*Prinia inornata inornata* Sykes. Juvenile plumage.
After Aug. 1849	✓ *Drymoica robusta* Blyth, J.A.S.B., xviii, p. 812—No locality [From Layard, Ceylon].	Preoccupied by *Drymoica robusta* Ruppell. *Prinia sylvatica valida* (Blyth).
After 5 May 1851	✓ *Drymoica valida* Blyth, J.A.S.B., xx, p. 180—No locality [Ceylon].	*Prinia sylvatica valida* (Blyth). New name for *Drymoica robusta* Blyth, preoccupied.

Date of Publication	Name, Reference, type locality and type	Identification and Notes
19 April 1854	*Prinia cinercocapilla* Horsf. & Moore, Cat. Birds E.I. Coy., pt. i, p. 322—Nepal. Type in the British Museum Reg. No. 1888.1.1.3061.	*Franklinia cinereocapilla* (Horsf. & Moore).
do.	*Drymoica nepalensis* Horsf. & Moore, Cat. Birds E.I. Co. Museum, vol. i (1854), p. 329—Nepal. Type in the British Museum, Reg. No. 1880.1.1.3038.	*Prinia inornata fusca* (Hodgson). Summer plumage.
1863	*Prinia adamsi* Jerdon, B. of I., vol. ii, p. 170—Poona. No type existed.	*Franklinia gracilis.* Cf. green in upper parts of *Prinia humilis* Hume.
22 Nov. 1866	*Prinia beavani* Walden, P.Z.S. 1866, p. 551—Schouay Goon, Salween river. Type in British Museum, Reg. No. 1888.4.20.494.	*Franklinia rufescens beavani* (Walden). Summer plumage.
Jan. 1867	*Suya gangetica* Blyth, Ibis 1867, p. 23—Upper Ganges. Type in the British Museum, Reg. No. 1881.5.1.403.	*Prinia sylvatica gangetica* (Blyth). Winter plumage.
March 1870	*Prinia albogularis* Walden, Ann. Mag. N.H. 1870, vol. v, p. 219—Coorg. Type in British Museum, Reg. No. 1888.4.20.467.	*Franklinia gracilis* (Franklin). Summer plumage.
Jan. 1870	*Prinia humilis* Hume, Ibis 1870, p. 144—North-West Provinces and the Punjab. There was no type.	*Franklinia gracilis* (Franklin). Winter plumage.
April 1872	*Drymoipus rufescens* Hume, Ibis 1872, p. 110—Mt. Aboo, Gurhwal and Kumaon, Nihar, Mahableshwar, Raipur, Etawah. This description is composite, taken from a series still in the British Museum (Reg. No. 1886.10.1.1560, etc). No specimen is mentioned as type. I accordingly restrict the type locality to Mt. Aboo, the first locality mentioned.	*Prinia sylvatica gangetica* (Blyth). Winter plumage.

Nov. 1872	*Drymoipus insignis* Hume, S.F., i, p. 10—Saugor, Mt. Aboo and Raipur. Original series in the British Museum, Reg. No. 1886.10.1.1524 is the type.	*Prinia sylvatica gangetica* (Blyth). Summer plumage.
1874	*Prinia rufula* Godwin-Austen, P.Z.S. 1874, p. 47—Naga Hills and Manipur. Type in the British Museum, Reg. No. 1899.5.31.47.	*Franklinia gracilis* (Franklin). Winter plumage.
After 31 Dec. 1874	*Drymoipus terricolor* Hume, N. & E. of Indian Birds, p. 349—N.-W. India=Oudh, Agra, 2.8.1867. Type in British Museum, Reg. No. 1886.10.1.1258.	*Prinia inornata terricolor* (Hume). Summer plumage.
Aug. 1875	*Drymoica blanfordi* Walden, J.A.S.B. 1875 (Extra No.), p. 118—Tonghoo, 17 May 1874. Type in British Museum, Reg. No. 1888.4.20.289.	*Prinia inornata blanfordi* (Walden). Summer plumage.
Sept. 1879	*Prinia brevicauda* Legge, Birds of Ceylon, p. 521—Ceylon.	*Prinia socialis brevicauda* Legge.
19 March 1878	*Prinia poliocephala* Anderson, P.Z.S. 1878, p. 370—Bagesur valley 3,000-4,000 ft., Kumaon.	*Prinia socialis stewarti* Blyth. Aberration.
Sept. 1879	*Drymoica insularis* Legge, Birds of Ceylon, p. 529—Ceylon.	*Prinia inornata insularis* (Legge).
10 July 1913	*Prinia inornata burmanica* Harington, Bull., B.O.C., xxxi, p. 111—Mandalay. Type, ♂ 27-6-1911, Mandalay (H. H. Harington) in British Museum, Reg. No. 1913.6.14.2.	*Prinia inornata blanfordi* (Walden). Summer plumage.
30 April 1923	*Prinia gracilis stevensi* Hartert, Bull., B.O.C., xliii, (30 April 1923), p. 132—North Lakhimpur, Upper Assam.	*Prinia gracilis stevensi* Hartert.
5 Jan. 1924	*Franklinia rufescens austeni* Stuart Baker, Bull., B.O.C., xl, p. 39—Lhota Naga Hills. Type, ♂ Lhota Naga Hills 19-12-1875 (A. W. Chennell) in British Museum, Reg. No. 1895.7.14.1989.	*Franklinia rufescens rufescens* (Blyth). Winter plumage.

Date of Publication	Name, Reference, type locality and type	Identification and Notes
19 April 1854	*Prinia cinereocapilla* Horsf. & Moore, Cat. Birds E.I. Coy., pt. i, p. 322—Nepal. Type in the British Museum Reg. No. 1888.1.1.3061.	*Franklinia cinereocapilla* (Horsf. & Moore).
do.	*Drymoica nepalensis* Horsf. & Moore, Cat. Birds E.I. Co. Museum, vol. i (1854), p. 329—Nepal. Type in the British Museum, Reg. No. 1880.1.1.3038.	*Prinia inornata fusca* (Hodgson). Summer plumage.
1863	*Prinia adamsi* Jerdon, B. of I., vol. ii, p. 170—Poona. No type existed.	*Franklinia gracilis.* Cf. green in upper parts of *Prinia humilis* Hume.
22 Nov. 1866	*Prinia beavani* Walden, P.Z.S. 1866, p. 551—Schouay Goon, Salween river. Type in British Museum, Reg. No. 1888.4.20.494.	*Franklinia rufescens beavani* (Walden). Summer plumage.
Jan. 1867	*Suya gangetica* Blyth, Ibis 1867, p. 23—Upper Ganges. Type in the British Museum, Reg. No. 1881.5.1.403.	*Prinia sylvatica gangetica* (Blyth). Winter plumage.
March 1870	*Prinia albogularis* Walden, Ann. Mag. N.H. 1870, vol. v, p. 219—Coorg. Type in British Museum, Reg. No. 1888.4.20.467.	*Franklinia gracilis* (Franklin). Summer plumage.
Jan. 1870	*Prinia humilis* Hume, Ibis 1870, p. 144—North-West Provinces and the Punjab. There was no type.	*Franklinia gracilis* (Franklin). Winter plumage.
April 1872	*Drymoipus rufescens* Hume, Ibis 1872, p. 110—Mt. Aboo, Gurhwal and Kumaon, Nihar, Mahableshwar, Raipur, Etawah. This description is composite, taken from a series still in the British Museum (Reg. No. 1886.10.1.1560, etc). No specimen is mentioned as type. I accordingly restrict the type locality to Mt. Aboo, the first locality mentioned.	*Prinia sylvatica gangetica* (Blyth). Winter plumage.
Nov. 1872	*Drymoipus insignis* Hume, S.F., i, p. 10—Saugor, Mt. Aboo and Raipur. Original series in the British Museum, Reg. No. 1886.10.1.1524 is the type.	*Prinia sylvatica gangetica* (Blyth). Summer plumage.
1874	*Prinia rufula* Godwin-Austen, P.Z.S. 1874, p. 47—Naga Hills and Manipur. Type in the British Museum, Reg. No. 1899.5.31.47.	*Franklinia gracilis* (Franklin). Winter plumage.
After 31 Dec. 1874	*Drymoipus terricolor* Hume, N. & E. of Indian Birds, p. 349—N.-W. India=Oudh, Agra, 2.8.1867. Type in British Museum, Reg. No. 1886.10.1.1258.	*Prinia inornata terricolor* (Hume). Summer plumage.
Aug. 1875	*Drymoica blanfordi* Walden, J.A.S.B. 1875 (Extra No.), p. 118—Tonghoo, 17 May 1874. Type in British Museum, Reg. No. 1888.4.20.289.	*Prinia inornata blanfordi* (Walden). Summer plumage.
Sept. 1879	*Prinia brevicauda* Legge, Birds of Ceylon, p. 521—Ceylon.	*Prinia socialis brevicauda* Legge.
19 March 1878	*Prinia poliocephala* Anderson, P.Z.S. 1878, p. 370—Bagesur valley 3,000-4,000 ft., Kumaon.	*Prinia socialis stewarti* Blyth. Aberration.
Sept. 1879	*Drymoica insularis* Legge, Birds of Ceylon, p. 529—Ceylon.	*Prinia inornata insularis* (Legge).
10 July 1913	*Prinia inornata burmanica* Harington, Bull., B.O.C., xxxi, p. 111—Mandalay. Type, ♂ 27-6-1911, Mandalay (H. H. Harington) in British Museum, Reg. No. 1913.6.14.2.	*Prinia inornata blanfordi* (Walden). Summer plumage.
30 April 1923	*Prinia gracilis stevensi* Hartert, Bull., B.O.C., xliii, (30 April 1923), p. 132—North Lakhimpur, Upper Assam.	*Prinia gracilis stevensi* Hartert.
5 Jan. 1924	*Franklinia rufescens austeni* Stuart Baker, Bull., B.O.C., xl, p. 39—Lhota Naga Hills. Type, ♂ Lhota Naga Hills 19-12-1875 (A. W. Chennell) in British Museum, Reg. No. 1895.7.14.1989.	*Franklinia rufescens rufescens* (Blyth). Winter plumage.

Prinia inornata franklinii Blyth.

This race of the Indian Wren-Warbler is a common resident all over the Nilgiris, chiefly above 5,000 ft. Its favourite haunts are the grassy downs of the plateau where it breeds in the patches of Berberis, Hill Goosebery and St. John's Wort which are so common in those areas. According to William Davison it is found all down the slopes into the Wynaad. Southwards it is common in the Palnis, chiefly above 5,000 ft. according to Fairbank, in long grass and fern thickets.

Ferguson considered that two forms were found in Travancore, one on the plains and hills up to 6,000 ft., and another apparently confined to the grasslands of Pirmeerd and the High Range. It is to be hoped that the Travancore Survey will provide material to settle the identity of these birds.

The breeding season in the Nilgiris is said to be from March to July.

Irena puella puella (Latham).

Coracias puella Latham, Index Orn., vol. i (1790), p. 171—India, restricted to Travancore (Stuart-Baker, Handlist, J.B.N.H.S. xxvii, p. 96).

Specimens collected:—313 ♂ ad. 2-6-29, 336 ♀ 5-6-29, 346 ♂ juv. 6-6-29 Chitteri range 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	28	126	102·5	17 mm.
♀	29	127	102	19 mm.

The Fairy Blue Bird is reported by LaPersonne to be fairly common about 2,000 ft. in the Chitteri range and this appears to furnish the first record of the bird on the eastern side of the Presidency. On the west it is very well-known and recorded as common in Coorg and the Wynaad, the Nilgiri slopes up to about 5,000 ft., the Nelliampathis and Plains up to 4,000 ft. and throughout the hills of Travancore from the jungles at their base up to about 3,000 ft. How far it occurs in the neighbouring lowlands is not very clear but there are specimens from Cannanore and Calicut in the British Museum.

The Fairy Blue Bird is usually considered a strictly resident species but in Coorg Betts (J.B.N.H.S., xxxii, p. 546) implies that it is a cold weather visitor, first noted on November 26. The breeding season in Travancore is said to be from January to May.

The fact that there are two races of the Fairy Blue Bird in India has been generally overlooked, though this might have been expected in view of its limited distribution in the north-east and south-west corners of the country. The difference is one of wing length. Twelve adult males from the latter area show a wing variation from 123 to 131 mm. Ten adult males from Sikkim and the Duars, on the other hand, show wing lengths from 133.5 to 141 mm. These figures do not overlap and the difference should be recognised.

Latham originally described his *Coracias puella* on the basis of Lady Impey's drawings, with no more definite locality than India. As Lady Impey was at Calcutta the natural implication is that her specimen came from the Darjeeling area and it is unfortunate therefore that Mr. Stuart Baker has restricted the name to the south, but as he has done this twice (*Travancore*, J.B.N.H.S. xxvii, p. 96; *Malabar, New Fauna*, vol. ii, p. 2) it must be accepted. A further advantage of restricting the name to the northern area would have been in that *Irena indica* Blyth (J.A.S.B., xv., pp. 308-309) would then have been available for the southern race. Blyth in naming this contrasted Malayan and Indian examples, and added that Arrakan and probably Tenasserim birds agreed with the Indian form. From his catalogue (p. 214) it is evident that his Indian specimens came from South India, and as the typical race has been restricted to South India *indica* becomes unfortunately a synonym of it. This leaves the northern race without any available name, for *Irena malayensis* Horsfield and Moore (Malayan Peninsula) with its much longer tail coverts of course is quite different to both of the Indian forms.

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I therefore propose to call the northern race

Irena puella sikkimensis subsp. nov.

Type ♂ Feb. 1911, Sukna, Darjeeling (H. King Robinson coll.). Brit. Mus. Reg. No. 1921-7-12-504.

Oriolus oriolus kundoo Sykes.

Oriolus kundoo Sykes, P.Z.S., 1832 (July 31) p. 87—Dukhun.

Specimens collected:—905 ♂ 11-10-29 Seschachalam Hills 2,000 ft.; 1132 ♀ 17-12-29, 1155-6 ♀♀ 22-12-29 Cumbum Valley; 1256 ♀? 15-1-40 Godaveri Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	29	142	93·5	23 mm.
4 ♀	28·5-31	132·5-138	80·5-92	21·5-23 mm.

The status of the Golden Oriole in the Presidency is not very clear, but there seems little doubt that the majority of, if not all, the birds are winter visitors. On the eastern side we have very little information beyond the above specimens. Dewar with his usual vagueness, says that it is not often seen during the hot weather at Madras, but is fairly common there in the winter. Captain Bates, however, tells me that there is a considerable movement of Orioles through Madras in the first three months of the year, but all have passed on elsewhere by April.

On the west there is rather more detail. In Coorg according to Betts, it is very common in the cold weather from the end of October (earliest date 23 October) to the end of March. William Davison procured specimens in the Wynaad at the end of March and the first week of April. In the Nilgiris it is common at low elevations below 5,000 ft. and is rarely seen above 6,000 ft. (Davison and Betts.) Here too they disappear about the middle of March as Mr. Betts informs me. There are two specimens in the British Museum collected by Wardlaw-Ramsay at Coonoor on 5 October.

Kinloch says that the Golden Oriole is very common in the Nelliampathis, but gives no further details. In Travancore too, our information is not very exact. Bourdillon said that it is not common but only ascends the hills in the cold season. Ferguson calls it resident and not common, sparingly met with in the plains and up to 3,000 ft. The only specimens I have examined from Travancore (Trivandrum and Mynall) were collected in November, December and March.

Oriolus chinensis diffusus Sharpe.

Oriolus diffusus Sharpe, Cat. Birds Brit. Mus., vol. iii (1877), p. 197—Malabar.

The Black-naped Oriole was not met by the Survey, though there is a male in the Tweeddale collection (British Museum) obtained at Vizagapatam by Major Wynch (no date). It appears to be an uncommon winter visitor to the western side of the Presidency. Jerdon states that he procured it from the Malabar jungles and there are a pair marked Malabar 1870 in the Hume collection as well as an undated female from Calicut. Hume says (S.F., x, p. 388) that he had received a specimen from the Wynaad, probably from near Manantoddy, sent to him as an unknown bird by a stranger. This specimen appears to be no longer in the Hume collection. Ferguson says that it is an occasional winter visitor to the low country in Travancore. He had a specimen from Trivandrum and in the British Museum there are five Travancore specimens (Fry: Bourdillon: Anjango) with no precise data.

There appears sometimes to be confusion between immature specimens of this Oriole and *O. o. kundoo*, but the above records are satisfactory.

In the Catalogue of Birds, vol. iii, p. 197, Sharpe rejects the name *Oriolus indicus* of authors on the ground that 'Brisson's description is totally inadmissible, unless, indeed, a Golden Oriole with blue in its coloration remains to be discovered, which is hardly likely!!! Brisson, however, never saw such a bird, but only took his description from the writings of others, viz. Aldrovandrus and Johnston. Now Aldrovandrus in his *Historia Naturalem*, vol. xii, p. 862, published about 1599, figures with very fair accuracy, a black-naped Oriole which he calls De chlorione Indico, but in the description says that the markings on the head, wings and tail are 'cæruleas'.

Johnston, Historiae Naturalis (1650-53) merely copies Aldrovandrus, but Brisson translates 'caeruleas' as 'bleue', hence the Oriole with the blue marks. According to the dictionary, however, 'cæruleas' also means 'dark coloured', so that Aldrovandrus was not so far wrong after all. It is not suggested, however, that *indicus* should be substituted for Sharpe's *diffusus*, for in any case Jerdon's *Oriolus indicus*, Ill. Ind. Orn., pl. xv, 1845 (March), is preoccupied by *Oriolus indicus* of Daudin in the Hist. Nat. de Buffon (Didot's edition) Oiseau, vol. xiv, 1799, p. 327, which is based on Le Loriot des Indes of the same work, vol. v, p. 328, and also of Brisson.

Oriolus xanthornus maderaspatanus Franklin.

Specimens collected:—311 ♂ 2-6-29, 321 ♂ 3-6-29 Chitteri range 2,000 ft.; 694 ♂ 15-8-29, 710 ♂ 19-8-29 Palkonda Hills 1,000 ft.; 975 ?♀ imm. 6-11-29 Nallamallai range 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	27-31	136·5-138·5	87	23-25 mm.
1 ♀	29·5	135	79·5	24 mm.

The Black-headed Oriole appears to be common and generally distributed in the Presidency. It is a resident species though probably here, as elsewhere in parts of India, it performs certain local movements.

In January LaPersonne found it abundant on wooded islands in the Godavery Delta, where it was particularly partial to 'English Tamarind trees'. Between there and Madras, where Dewar considered it far from common, the only records are furnished by the Survey specimens. In May and June in Salem district the Survey found it common in the hills and the plains, particularly at about 2,500 to 3,000 ft., occurring also up to 4,500 ft.

From the western side a specimen from Coorg (Tweeddale coll.) is in the British Museum, though Betts does not include it in his list. It occurs in the Wynaad (William Davison) and in the Nilgiris where it extends rather higher than *O. o. kundoo*, Davison stating that he had met with it right up to Ootacamund. A female from Palghat (7-12-1871) is in the Hume collection. Colonel Sparrow obtained an immature female from Malappuram (22-4-1912). Southwards it appears to be less of a hill bird than in other parts of its range. At any rate Kinloch specifically states (J.B.N.H.S., xxvii, 940) that it does not occur in the Nelliampathis; and though Fairbank found it in the Palnis from the base up to 5,000 ft. and Terry considered it common in the Pittur valley, Bourdillon and Ferguson state that in Travancore it is a bird of the low country, where it is the commonest Oriole. Bourdillon said that it ascended the hills in the cold season but this was later denied by Ferguson.

There are no records of the breeding season in our area.

The *New Fauna* divides the Black-headed Oriole into two races, namely *ceylonensis* in Ceylon and the extreme south of Travancore, and *xanthornus* for the remainder of the Indian range, and eastwards to Indo-China. According to the key these are easily distinguished on wing measurement, *ceylonensis* never exceeding 130 mm. We, however, find that out of twelve adult males from Ceylon, seven exceed this measurement. We prefer, however, to treat this species as falling into three races. If Himalayan and Cinghalese birds are contrasted they are very different, both in size and certain details of colouration. Peninsula birds, however, are definitely intermediate and do not fit into a definition of either form. It therefore appears best to treat them as an intermediate race and we accordingly recognise the following forms.

Oriolus xanthornus xanthornus (L).

Coracias xanthornus Linnæus, Syst. Nat. ed. x (1758), p. 108—Bengal.

(*a*) Size large:

	Bill.	Wing.	Tail.
20 ♂	(Once 29·5) 30·5-33	135·5-150·5	86-99·5 mm.

(*b*) The yellow on the inner secondaries and tertiaries is very extensive, forming a wide edging.

(*c*) In first-year birds a broad yellow band on the forehead is accompanied by yellow edging to all the black feathers of the crown and nape.

Sub-Himalayan ranges from Kangra to Upper Assam: the Gangetic plain.

Oriolus xanthornus maderaspatanus Franklin.

Oriolus maderaspatanus Franklin, P.Z.S. 1830-1 (October 25, 1831), p. 118—Ganges between Calcutta and Benares, and in the Vindhyian Hills between the latter place and Gurrah Mandela on the Nerbudda; now restricted to Jubbulpore.[1]

(*a*) Size intermediate:

	Bill.	Wing.	Tail.
17 ♂	27-32	131-139·5	82-86·5 mm.

(*b*) Yellow on inner secondaries and tertiaries as in *ceylonensis*.

(*c*) In first-year birds there is a fairly broad yellow frontal band but the yellow edging to the feathers of the crown and nape is much reduced and often absent.

India south of the Gangetic plain, not occurring north and west of Mount Aboo and Kathiawar.

Oriolus xanthornus ceylonensis Bonaparte.

Oriolus ceylonensis Bonaparte, Consp. Gen. Av., vol. i (1850), p. 347—Ceylon.

(*a*) Size small:—

	Bill.	Wing.	Tail.
12 ♂	27·5-31	124·5-135	77·5-84 mm.

(*b*) Yellow on inner secondaries and tertiaries reduced to terminal spots.

(*c*) In first-year birds the yellow on the head is reduced to a narrow or almost obsolete frontal band.

It should perhaps be explained that in this Oriole the adult female only differs from the adult male in the paler, less rich yellow of the upper plumage. In first-year plumage, retained till the second autumn, both sexes agree in having the black of the chin and throat replaced by black and white striping. This was correctly diagnosed in the *Old Fauna* though in the *New Fauna* the first-year plumage is incorrectly given as that of the adult female. The variation in the size of the yellow patch on the primary coverts and the amount of black in the tail is purely individual within our limits, though further east the latter point apparently becomes of subspecific value.

Specimens of the Black-headed Oriole from the Andamans appear to be even smaller than the Ceylon form, but there is apparently some doubt as to the status of the bird in that group (vide S.F., ii, 230 and J.B.N.H.S., xii, 396 and xvii, p. 158).

Gracula religiosa indica (Cuvier).

Eulabes indicus Cuvier, Règne Anim., 2nd ed., vol. i (1829), p. 377, based on Pl. Enlum., vol. iv, pl. 268 (45)—India [=S. India].

Not observed anywhere by the Survey. The Southern Grackle is a common bird on the western side of the Presidency, occurring very commonly in Coorg, the Wynaad, the Nilgiris up to 4,000 or 5,000 ft., the Nelliampathis, the Palnis up to 4,000-5,000 ft. and in Travancore. In Travancore it is one of the commonest, noisiest and most conspicuous birds found in the hills up to 3,000 ft. in the south and up to 5,000 ft. in the High Range, breeding most abundantly from 1,500 to 3,000 ft. How far it occurs out of the hills is not very clear but in the British Museum there are four specimens from Malabar Tweedale Coll.) and one from Cannanore (ditto). Northwards out of our boundary it extends to North Kanara and possibly also to the south-west of Belgaum or even possibly the South Konkan ghats (S.F., ix, 414).

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[1] It may seem strange that Franklin should use the name *maderaspatianus* for an Oriole described from the Central Provinces, but the explanation appears to be that he considered it the same as *Oriolus galbula* var. y Latham, Index Ornithologicus vol. i, p. 187, based on the *Icterus maderaspatianus naevius*, Brisson Ornithologie, vol. ii, p. 90, which in turn is based on the description and figure in Ray's *Synopsis Avium*, p. 195, table i, fig. 7, 1713, of the Mottled Jay from Madras, i.e. a Black-headed Oriole.

As, however, the description appears to be taken from a specimen collected by Franklin and not based on the description of Latham, Brisson or Ray of a Madras bird, the type locality may be fixed as Jubbulpore.

The breeding season is apparently in the main from March to June, but Stuart Baker adds January and February, and J. Darling September and October to these months.

There are three clearly defined areas in India where the Grackle occurs as a strictly resident species, namely the Himalayan foothills from near Almora to Assam, the area to the south of Chota Nagpur, and south-west India as given above. These areas are widely separated by huge tracts where the species does not occur at all and there are recognisable differences between the birds of all three areas, though they clearly grade into each other.

In south-west India the conspicuous side wattle is extended up the back of the nape to the crown in the shape of a narrow tongue. This narrow tongue is appreciably diminished in birds from North Kanara and it is entirely absent in birds from the other two Indian areas. That part of the wattle situated over the ear coverts is also variable in different areas. The band which connects the base of the two lobes is very narrow in the south-west, so narrow that it barely shows save as a division in the feathers. In the Himalayan race this band is broad and conspicuous, and there are further differences in the typical race. As these differences are evidently only of racial importance one must view with some suspicion the elevation of the Ceylon bird *Gracula ptilogenys* to the rank of a full species, differing merely in the total suppression of the wattle on the ear coverts though a division in the feathers recalls it. It is possible that further research will provide some explanation for the existence side by side in Ceylon of two forms apparently only subspecific in value.

In dividing the Indian Grackles into two species and thinking the presence or absence of the wattle on the nape of specific value, Mr. Stuart Baker appears to have been misled by the old records for he has failed to realise that the authors who variously record *religiosa* and *intermedia* from the area south of Chota Nagpur were both referring to the same bird. Hume had already pointed out that and showed that it was an intermediate (vide S.F., ii, 254 and vii, 222). From *G. r. indica* of the south-west the absence of the wattle from the nape to the crown at once distinguishes it. From *G. r. intermedia* of the sub-Himalayas it may be distinguished by its finer and shorter bill and its smaller size, ♂ bill 29-30.5, wing 158-164.5, tail 72-74 mm. as compared with ♂ bill 30.5-33, wing 169-176.5, tail 78-84 mm. in *G. r. intermedia*. We are of opinion that this intermediate may be usefully recognised and propose for it the name

Gracula religiosa peninsularis subsp. nov.

Type. ♂ Sambalpur 1st January, 1873 (Hume collection). British Museum Register No. 1877-7-1-887.

Lamprocorax panayensis (Scopoli).

Muscicapa panayensis Scop., Del. Flor. et Fauna Insubr., vol. ii (1783), p. 96—Panay.

Although both editions of the *Fauna* pass over the record in silence there appears no reason to disbelieve that the Glossy Starling has occurred near Madras. In S.F., ix, p. 298, Mr. W. F. Dique reports that a young female, probably of the species that occurs in the Andamans and Nicobars, was captured at Poonamallee, about 12 miles west of Madras, on the 9th October, 1880. It was feeding on a Banyan tree among a lot of Mynahs, Barbets and other birds.

Pastor roseus (Linn).

Turdus roseus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 170—Lapland.

The Rosy Pastor was not reported by the Survey and there is very little accurate information about its status in the Presidency. There is an undated specimen from Nursiputum near Rajamundri in the Hume collection. Dewar says that it is not common at Madras but Jerdon says that it usually makes its appearance in the Deccan and Carnatic about November in vast flocks, quitting the south of India again about March.

In Travancore, Ferguson says that it is found in large flocks both in the low country and on the hills, from September to April usually, though he had seen them occasionally as late as May.

The probability is that the numbers which arrive in the Presidency vary from year to year, depending on the food supply in other parts of India.

Sturnus vulgaris poltaratskyi Finsch.

Sturnus vulgaris poltaratskyi, Finch, P.Z.S.., 1878 (October) p. 713—Marka Kul, Chinese Altai.

The Starling is evidently an occasional straggler to the Madras Presidency as I have examined two specimens, both of this race. The first is an unsexed specimen in the Wardlaw-Ramsay collection in the British Museum labelled in his handwriting '1876 Madras'. The second is an old and faded specimen from Madras in the Madras Government Museum, kindly sent to me for inspection by Dr. Gravely. Dewar's remark that the Starling is only rarely seen at Madras may be only based on these records.

Sturnia malabarica malabarica (Gmelin).

Turdus malabaricus Gmelin, Syst. Nat. vol. i, pt. ii (1789), p. 816—Malabar Coast.

Specimens collected:—1120 ♂ 16-12-29 Cumbum Valley: 1205-6 ♀♀ 8-1-30, 1217-8 ♀♀ 10-1-30, 1262-3 o? ♀ 19-1-30 Godavery Delta; 1570 ♀ 19-3-30, 1585 ♂ 23-3-30, 1611A 1611B 1612 ♀♀♀ 27-3-30 Sankrametta 2,000-3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	20·5-22	101-104	60-64	23·5-25 mm.
8 ♀	20·22	94-104	55-65	22-24 mm.

LaPersonne reports that the Grey-headed Mynah was common in large flocks in early March at Anantagiri and Sankarametta in the Vizagapatam ghats. Towards the first week in April pairs were seen and some of the last birds obtained had the organs enlarged. A specimen from Jeypore is in the Tweeddale collection in the British Museum.

In January it was common on the wooded islands of the Godavery Delta in large flocks which principally fed at the flowers of the 'English Tamarind' tree in company with Orioles. Common Mynahs and Drongos.

The specimen from the Cumbum valley and Dewar's statement that the bird is a fairly abundant winter visitor to Madras comprise the rest of the records for the eastern side of the Presidency, though there is also of course Jerdon's statement (Madras Journ. Lit. Sci., xi, p. 23) that he had seen and shot it in the Carnatic in the cold season.

On the western side, we have not been able to clear up the exact situation between the typical race and *blythii* as explained in detail under that form. It does, however, occur there though its status is not very clear.

William Davison states that it occurs sparingly in the Wynaad and this is substantiated by a male in the British Museum collected by Darling on 21-11-1877. Davison also tells us that it occurs sparingly on the slopes of the Nilgiris, apparently not above 5,000 ft., and that he has seen it as late as the end of April on the Coonoor ghat (S.F., x, 401).

In Travancore, Bourdillon and Ferguson call it common in considerable flocks in the jungle at the foot of the hills, rarely ascending to 2,000 ft. These accounts suggest that the bird is a winter visitor to this area, but one or other race evidently breeds in Travancore, as Colonel Sparrow informs me that he took two fresh eggs at Komili in the Cardamum hills on 4 April 1914. These he attributed to the typical race.

Sturnia malabarica blythii (Jerdon).

Pastor blythii Jerdon, Madr. Jour. Lit. Science, vol. xiii (1844), p. 133—Malabar.

Unfortunately the range of Blyth's Mynah lies to the west of the area covered by the Survey and no fresh material has therefore been obtained to throw light on the exact distribution of this very good race in relation to the typical form. As both races are local migrants there is some confusion on the point and this confusion has been heightened by the account in the *New Fauna* which is very misleading. This states that Blyth's Mynah is found 'breeding on the Malabar coast and Travancore south of Belgaum.' Belgaum seems to be the meeting-ground of the two races when breeding, and many specimens from that district are intermediate between the two, whilst some individuals are much nearer one than the other. Breeding birds from the Wynaad, Nilgiris and Palnis all appear to be of this race.'

Blyth's Mynah is only definitely recorded as breeding in N. Kanara in April (Davidson, J.B.N.H.S., xi, p. 666), in Coorg (Betts, J.B.N.H.S., xxxiii, p. 547) and those parts of Mysore bordering on the Wynaad in April and May (Macpherson apud Hume N. & E. second ed., vol. ii, p. 371) Davidson's identification is evidently correct as his full account (loc. cit. and also vol. v, p. 109) is substantiated by a series of skins in the British Museum. Macpherson's identification was confirmed by Hume who received a skin with the eggs. Mr. Betts does not appear to have actually collected any specimens and the two labelled Coorg in the Tweeddale Museum are not very definitely attributable to this race, but his identification is probably correct as an adult male and two juveniles in the British Museum collected by William Davison on 11 and 13 May at Karote at the foot of the Balasore peak in the Wynaad (S.F., x, 401) suggest that this form also breeds in the Wynaad. We have seen no evidence that either race breeds in the Nilgiris or the Palnis. In regard to Belgaum Butler paid a great deal of attention to these two forms which evidently interested him specially as he wrote on them at full length in *Stray Feathers* (vol. ix, pp. 238, 267 and 414). His account is quite clear. Of *blythii* he says: 'They arrive in Belgaum in large numbers towards the end of May and beginning of June in very bad plumage and remain all through the rains, leaving again about October, by which time they are in perfect plumage'. Examination of his fine series shows that during this rains' visit the birds undergo their post-nuptial moult and the intermediate specimens of Mr. Baker's account are evidently birds in moult from first year to adult plumage. *Malabarica* on the other hand 'arrives shortly after *blythii* has left in October and is common all through the cold weather' (S.F. ix. 238). There is no evidence that either form breeds in the Belgaum area at all.

In the Madras Presidency the range and status of Blyths' Mynah cannot at present be satisfactorily defined. It is confined entirely to the western side and we have traced the following records of it. In Coorg according to Betts (loc. cit.) it is a very common resident, breeding in barbet holes in high trees and roosting in the cold weather in large numbers in reed beds in company with common Mynahs. In the Wynaad, according to Jerdon (B. of I., vol. ii, p. 332) it is found up to 2,000 ft. but William Davison evidently did not consider it common, only meeting the specimens above mentioned.[1]

Otherwise it is only recorded from Travancore. Ferguson (J.B.N.H.S. xv. 162) says that he never met with it personally, but that F. W. Bourdillon obtained it in the hills in March and his own collector took two specimens in April at the foot of the hills. The Bourdillon specimen, dated 9-3-76, is in the British Museum as well as two other birds from Travancore (Fry) with no very definite data.

Six other specimens in the British Museum (Gould, Whitley, Indian Museum, Tweeddale, Jerdon) are labelled Madras or Malabar, with no more precise data and may be disregarded.

Temenuchus pagodarum (Gmelin).

Turdus pagodarum Gmelin Syst. Nat., vol. i, pt. ii (1789), p. 816—Malabar.

Specimens collected:—83 ♀ 18-4-29, 158 ♂ 30-4-29 Kurumbapatti; 763-765 ♂ juv. ♂♂ 27-8-29 Palkonda Hills 500 ft.; 928 ♂ 18-10-29 Seschachalam Hills 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	20-22	99-109	60·5-74	25·5-29 mm.
1 ♀	20·5	99	58	29 mm.

Save for Jerdon's statement that it is common in the southern portion of the Northern Circars we can trace no record of the Brahminy Mynah in the Madras Presidency north of the Seschachalam Hills and the Palkonda Hills, where the above specimens were procured by the Survey. About Madras, according to Dewar and Benjamin Aitken (N. & E., 2nd ed., i, 376) it is one of the commonest birds and at Poonamallee, 12 miles west of Madras, it is mentioned by Dique (S.F., iv, 298). About Kurumbapatti LaPersonne met occasional pairs feeding around the village. Mr. A. G. R. Theobald records it as breeding at Ahtoor in the Shevaroys (N. & E., 2nd ed., i, 376). Jerdon found it numerous at Trichinopoly. It doubtless occurs all through this area as it was obtained on Rameswaram Island (S.F., iv, 459), and Ferguson says that it is not uncommon in Travancore in the extreme south about Nagercoil and Cape Comorin.

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[1] In the reference quoted he only mentions two specimens but there are three from him in the British Museum.

On the western coast it is less numerous. Davison tells us that at Ootacamund it is a straggler (doubtless from the Mysore territory), joining in with the flocks of Jungle Mynahs, but lower down it is probably commoner, as the British Museum possesses three birds obtained by him in February at Segore (Sigur) and a specimen collected by Wardlaw-Ramsay on the Coonoor Ghat on 5 October.

Fairbank found it well up on the hillsides of the Palnis, but probably this is only an extension from the plains on their eastern base.

As to the breeding season in the Presidency, Mr. Benjamin Aitken observed young in nests at Madras in June and July and Theobald found eggs at Ahtoor early in August.

This widespread and common species has no races.

Acridotheres tristis tristis Linn.

Paradisea tristis Linn., Syst. Nat., ed. xii, vol. i (1766), p. 167—Philippines.

Specimens collected:—301 ♂ 1-6-29, 324 ♂ juv. 3-6-29 Chitteri range 2,000 ft.; 754 ♂ 26-8-29 Palkonda Hills 500 ft.; 955 ♂ 1-11-29 Nallamallai range 2,000 ft.; 1222 ♂ 10-1-30 Godavery Delta; 1447 ♂ 26-2-30 Anantagiri 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	26-29	137·5-148	81·5-92	34-40 mm.

The Common Mynah appears to be so generally distributed in the Madras Presidency that there is no need to cite the various records on the point. It is not clear, however, whether it reaches the highest elevations of the hill ranges of the south-west and in Travancore, Ferguson implies that it does not ascend the hills, though Fairbank mentions it at 4,000 ft. in the Palnis. Dewar gives an interesting note about the relations of the Mynah and the King Crow at Madras (J.B.N.H.S., xvi, 364). Nothing is recorded about the breeding season in the Presidency, except that Ferguson states it breeds in April in Travancore.

One point requires attention. Legge (A. & M.N.H., 5th series, vol. iii, p, 168, February 1879 reprinted S. F., viii, 72) remarks on the resemblance of specimens from Travancore to the Ceylon race *melanosternus* and Mr. Stuart Baker (*New Fauna*, vol. iii, p. 53) suggests that they may require separation as an intermediate form. There are, however, only three specimens in the British Museum and it will be as well to await the further material from the Travancore Survey to decide the point.

Acridotheres ginginianus (Latham).

Turdus ginginanus Latham, Index Orn., vol. i (1790), p. 362—Gingee.

Jerdon long ago remarked that in spite of its specific name taken from Gingee in Madras the Bank Mynah does not occur in southern India. The type locality was, however, probably correct and based on an actual specimen from Gingee, for B. Sundara Raj, Zoological Assistant to the Madras Government Museum, procured a single specimen on 14 January 1914 at Vandalur, 20 miles south of Madras (J.B.N.H.S., xxiii, 155). It was in company with some Common Mynahs.

The southern boundary of this north Indian form is commonly said to be the Nerbudda and Mahanadi rivers. It has however been recorded in small numbers from western Khandesh, Nasik and Bombay (Barnes, J.B.N.H.S., v, p. 106: J. Davidson, S.F., x, p. 312).

Aethiopsar fuscus mahrattensis (Sykes).

Pastor mahrattensis Sykes, P.Z.S. 1832 (July 31), p. 95—the Ghauts [near Poona].

Specimen collected:—252 ♀ 19-5-29 Shevaroy Hills 4,500 ft.

Measurements:—

Bill.	Wing.	Tail.	Tarsus.
25	125·5	73	33·5 mm.

A female, now in the British Museum, collected at Yercaud, Shevaroys, on 11 February 1869 by Theobald and the above specimen (incubation patch marked on label) are the only specimens examined from the eastern side of the Presidency, but it is said by LaPersonne to be common in the Shevaroys and Chitteri range.

On the western side the Jungle Mynah is well known. It is common in the Wynaad, and very abundant in the Nilgiris, especially on the higher ranges. Terry says that it is common round most of the villages in the Palnis.

In Travancore, however, Ferguson says that it does not ascend the hills but is common in well-wooded parts of the low country up to their foot.

The breeding season in Nilgiris is said by Wait (N. & E., 2nd ed., vol. i, p. 384) to extend from the end of February to the beginning of July. Miss Cockburn considered March and April to be the principal months for eggs and other records agree with these limits. In Coorg Betts records nests in March and May.[1]

Mr. Stuart Baker says (vol. iii, p. 57) that he 'cannot separate *mahrattensis* of Sykes. The southern bird differs only in the adult not acquiring a yellow iris'. With this I am unable to agree. The Jungle Mynahs of the Indian Empire fall into two distinct shades of colouration on the upper parts. The birds of northern India, which breed along the outer Himalayas from Murree to Assam, are all slate coloured above, paler and grayer in the western Himalayas and darker and blacker in the eastern Himalayas. It is possible that they really fall into the usual eastern and western races of this area, but I have not examined a sufficiently good series to settle this point. All adults have the iris bright yellow. This slate coloured bird represents the typical race and as the type locality is merely 'India' I now restrict it to Sikkim in case the west Himalayan bird should prove distinct.

The birds of southern and western India have the upper parts brown in tint and iris grey, bluish white or pale blue. These are good racial differences and should be recognized under Sykes' name *mahrattensis*.

Aethiopsar fuscus torquatus (Davison)[2] from Burma and Malaya is a perfectly good race, although unfortunately based on a colour aberration. Mr. Stuart Baker says that it differs from the typical race only in being smaller, wing under 120 mm. in his key. This is hardly correct. Six males taken at random give wing measurements of 122.5-126 mm. The race is intermediate. It has the yellow iris of the typical race and the brown tint of *mahrattensis*.

Sturnopastor contra (Linn.).

Sturnus contra Linn., Syst. Nat., ed. x, vol. i (1758), p. 167—India, Calcutta.

Jerdon tells us that the Pied Mynah is found all along the Northern Circars from Goomsoor to near Masulipatam. He adds that it is more abundant here than anywhere else that he had seen, occuring in vast flocks of many hundreds.

LaPersonne states that the bird was quite common round Vizianagram town. It is unfortunate that no specimens were procured as it is not safe to assume the race of the birds from this area and there are none in the British Museum, unless a Gould specimen labelled 'Madras' came from there. This is probable as the Pied Mynah is not known to occur further south in the Presidency.

(*To be continued*).

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[1] J.B.N.H.S., xxxiii, 546 Recorded in error as *Acridotheres tristis*, as Mr. Betts has since informed me.

[2] *Acridotheres torquatus* Davison, Ibis 1892, p. 102—Pahang.

THE GAME BIRDS AND ANIMALS OF THE MANIPUR STATE WITH NOTES ON THEIR NUMBERS, MIGRATION AND HABITS.

BY

J. C. HIGGINS, I.C.S.

PART II

(*Continued from page 422 of this volume.*)

The Crested, Falcated or Bronze-capped Teal (*Eunetta falcata*).

A regular visitor, appearing in the bag since 1910. It has been shot every year since 1921-22. The earliest recorded was shot on November 6th (1927), and the latest on March 31st (1927). The greatest number shot in a year was 8, in 1927-28. It is more than possible that a few more of this species have been shot and classified as female Gadwall.

The Gadwall (*Chaulelasmus streperus*)—Manipuri, *thoidingnam* ('sesamum-flavoured').

Quoting Colonel Wood, Baker[1] says that the Gadwall 'begin to arrive in Manipur about October 15th and leave about the end of March'. This is generally correct, though stragglers remain after March. The earliest recorded in the Game Book was shot on October 28th (1917), and the latest on April 27th (1924): my shikaris reported having seen two on June 14th, 1925. But it must be remembered that the number of duck in the valley is not such as to tempt one to shoot them much before the last week in October or first week in November and again after the beginning of April. Snipe are very numerous in October and April, and supply a counter-attraction. Hence, the earliest and latest dates on which duck have been shot are not an accurate index of their seasons of migration. Gadwall, generally speaking, are not present in great numbers before the last week in November or after the first week in March. The percentages of the total bag of Gadwall from 1915-16 (when the figures began to be representative) to 1931-32, killed in the various months of the season, are:—

November	...	11 per cent
December	...	44 ,,
January	...	20 ,,
February	...	17 ,,
March	...	8 ,,

The percentage killed in December is, as in the case of all the ducks, unduly high, the time available for shooting in that month being greater than in other months, owing to the Christmas holidays.

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[1] Op. cit., p. 150.

The best year for Gadwall was 1924-25, when 760 were shot. Good days were:—

27-12-22	... 174
27-12-24	... 132
28-12-22	... 114
18-12-27	... 85

A curious feature of the migration of the Gadwall is that in some years it is very noticeably common and in others equally noticeably scarce. This characteristic has also been noted by Baker[1] in the case of the Wigeon. It will be seen from the records that, whereas in 1922-23 the Gadwall provided upwards of 30 per cent of the total bag of duck, in 1927-28 its percentage fell as low as 7.33 per cent. Naturally the percentage of all ducks varies with changing conditions of climate, water and feed, but the irregularity in numbers is particularly obvious in the case of these two species.

Both Baker[2] and Finn[3] agree that Gadwall, in the words of the latter, 'are not naturally remarkable either for shyness or its opposite, though after persecution they give trouble enough to the gunner'. My experience is that, if pursued in a boat, they very soon become familiar with the range of a gun and keep out of danger. But if one's butt can be placed in a corner where they want to settle, they continue to fly over it frequently and not too fast, and a large bag can be made. The same applies in a varying degree to all the duck, but Gadwall and, more rarely, Pintail are sometimes extremely loth to give up their intended resting-place.

Another characteristic of this species noticed by Colonel Wood and quoted by Baker[4] is the tendency to pair before migration. This tendency is also characteristic of the Shoveller and is, perhaps, even more noticeable in the Common and Garganey Teals. The birds begin to pair at least a month and frequently two before migration. I have not observed this habit in the Pintail or the Pochards.

The Gadwall, as Baker[5] remarks, is one of the best of the table ducks. Personally, I give precedence to the Teals, closely followed by the Spotbill and Mallard, closely followed again by the Gadwall and the Pintail.

The Wigeon (*Mareca penelope*)—Manipuri, *thānggongmāl* ('like the Brahminy', referring to the drake's ruddy head).

The Wigeon is not a particularly early arrival nor a late stayer. The percentages killed in the different months of the season are:—

November	... 10 per cent
December	... 38 ,,
January	... 24 ,,
February	... 17 ,,
March	... 11 ,,

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[1] Op. cit., p. 157.
[2] Op. cit., p. 151.
[3] Op. cit., p. 8.
[4] Op. cit., p. 150.
[5] Op. cit., p. 151.

But, as has already been mentioned in commenting on the Gadwall, this species is a very irregular visitor in point of numbers. Though it never carries this irregularity to the point of failing to appear altogether, there have been several years when the number bagged has fallen very low—noticeably 1931-32, when only 4 were shot, out of a total bag of upwards of 3,200 duck. But even when it is comparatively plentiful, it is never found in such numbers as the Pintail, Gadwall, the Teals and the Pochards, or even the Shoveller, and only forms 1.12 per cent of the total bag of duck. When, therefore, Baker[1] says that 'in some years it is very numerous in Manipur', he must be speaking comparatively. The best year's bag was in 1924-25, when 111 birds were shot, providing just over 3 per cent of the total number of duck. This is followed by 88 in 1930-31 and 75 in 1927-28, forming 1.8 per cent and 1.5 per cent respectively of the total bags for those years. The next best is 48 in 1929-30—less than 1 per cent.

The earliest date on which this species was shot was October 31st (1926), though in 1923 some were seen on September 30th. The latest shot was on April 17th (1925). Good days were:—

29-1-25 ...	26
27-12-24 ...	22
1-3-28 ...	22

Baker[2] says of the Wigeon that they 'vary very much in being wild or the reverse, but, taking them everywhere, they may be said to be cute, wary birds'. This is very much the case in Manipur. My experience of them is that they share with the Pintail an uncanny quickness in noticing the slightest movement in the butt and swerving away. This characteristic and their 'swift, powerful flight' contribute largely to their scarcity in the bag. The Wigeon is easy to identify in flight by the very conspicuous band of white in the wing of the drake, and by its handsome lines. It shares with the Pintail the distinction of possessing a beautifully 'stream-lined' body and delicately curved wings.

I have never noticed the large flocks referred to by Baker.[3] As a table bird the Wigeon in Manipur is definitely inferior.

The Common Teal (*Nettion crecca crecca*)—Manipuri, *surit*: some of the villages in the south of the valley also know it as *leingāngchābi*.

It seems to be a moot point whether this duck or the Garganey Teal is the earlier arrival in India. Baker[4] quotes Hume as saying that the Garganey is the first in the field, but comes to the conclusion that they 'arrive at much the same time, though one year the Garganey may be the first and the next year the Common Teal'. There is little doubt that this is correct. In Manipur the Common Teal has been reported as seen by shikaris on August 22nd (1924), August 27th (1915 and 1927), and by a member of the Club on August 21st (1932): one was shot on September 20th, 1931. As regards the Garganey, it has been reported by shikaris on August 19th (1929), and actually shot on September 12th (1926). Of course, in the case of birds not actually shot, one species may possibly have been mistaken for the other, especially at the beginning of the season, before the drakes get their full plumage. The Manipuri Muhammadan shikaris, who have a considerable knowledge of birds, and are keen observers and skilful at identifying duck on the wing, say that the Common Teal is usually the first arrival in the valley. Finn[1] says that October sees the arrival of the main body. But in Manipur, as with most of the other duck, the main migration takes place in November.

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[1] *Fauna of British India*, vol. vi, p. 430.

[2] *Indian Ducks and their Allies*, p. 158.

[3] Op. cit., p. 159.

[4] Op. cit., p. 169,

Whichever arrives first, there is no doubt as to which leaves first. The Common Teal, by far the most numerous duck in Manipur, especially during December and January (it forms 28.12 per cent of the total duck bag for the period, and in 1928-29 rose as high as 40.8 per cent of the year's bag), begins to disappear in February, is scarce in March, and very rare in April. The Garganey, on the other hand, is comparatively scarce before March, and common in that month and early April. The monthly percentages of Common Teal shot are:—

November	... 17	per cent
December	... 52	,,
January	... 16	,,
February	... 12	,,
March	... 3	,,

Since 1910, out of a total of 15,982, only 595 have been shot in March and 16 in April, the latest recorded being on April 21st, 1929.

The late Captain D. Dundas, 17th Infantry, told me that he had once found a duckling of this species, immature and unable to fly, when shooting snipe in Manipur, early in the season. This was doubtless bred by injured parents which had not been able or inclined to migrate, as the Common Teal is not resident and I have never heard of another instance of its breeding in the State.

The best year's bag is 2,434, in 1928-29. Good days were:—

6-12-25	... 443
20-12-25	... 299
16-12-26	... 291
2-12-28	... 284
8-12-29	... 249
1-2-31	... 249
18-12-27	... 236
14-12-30	... 206
21-12-24	... 205
16-12-28	... 203
27-12-28	... 202

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[1] Op. cit., p. 15,

Baker[1] comments on the tameness of the Common Teal. This is specially true on *bils* where there is cover, and in the middle of the day, when the birds may often be seen sleeping on the water. I remember shooting once with a party which included a Gurkha Subadar of the 4th Assam Rifles. He started out with 100 cartridges, and when the bag was totalled up, he produced 84 birds, mostly Common Teal. Needless to say, none of the rest of the party, who had been shooting from butts, could compete with this average, though some had better bags. But I happened to ask the Subadar, who had been shooting from a boat, whether he had used all his cartridges, when, to my surprise, he replied, 'No, Sahib, only 52!'. But it is as a driven bird that the Common Teal is 'one of the most attractive of the duck tribe to the sportsman'. It occupies the same relation with regard to the majority of other ducks that the Frenchman does among driven partridges. For, from the moment he becomes aware of trouble ahead, the Common Teal, instead of swerving off to one side, as do most of the ducks, more often than not accelerates his speed and alters his altitude, passing the butt like a bullet out of a gun. This characteristic is shared to a lesser degree by the Garganey and the Tufted and White-eyed Pochards. And when the Common Teal does accelerate, he is probably only surpassed in speed by the Pintail, if at all.

My observations confirm Baker's[2] conclusions that these birds are expert divers when among reeds or floating grass, and avail themselves of cover with baffling skill. But, when wounded, they will often climb out of the water on to floating grass, like the Grey Lag and the Spotbill—a thing the Pochards will never do.

This teal has been shot in the hills at an altitude of 5,000 ft.

The authorities are agreed on the excellence of the Common Teal as a table duck: I think he is only surpassed in this respect by the Garganey.

The Baikal or Clucking Teal (*Nettion formosum*).

Only twice recorded. I shot one out of a small flock of 8 or 10 on March 16th, 1913, and another on November 28th, 1915. The identification of the former was confirmed by the Society.

The Pintail (*Dafila acuta acuta*)—Manipuri, *meitungā* (not *laitungā*, as in Finn[3] and Baker[4]).

Of the Pintail, Baker[5] says that 'in the East, few arrive until November'. As mentioned above in noting on the Common Teal, the main migration of all the duck into Manipur takes place in November, and no species arrive in very large numbers before that month. But the advance guard of the Pintails certainly arrive early. My shikari reported having seen Pintail (an easy duck to identify on the wing) on August 27th, 1915. I myself saw some on September 6th, 1913: and two were shot on October 1st, 1922. Respectable bags of Pintail are not infrequently made in November. This species, like the Common Teal, leaves early though I have shot one (probably a pricked bird) as late as May 13th (1917), and my shikari reported having seen one on July 28th, 1924. The percentages bagged in the different months of the season are:—

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[1] Op. cit., p. 170.

[2] Op. cit., p. 171.

[3] Op. cit., p. 12.

[4] *Fauna of British India*, vol. vi, p. 437.

[5] Op. cit., p. 439.

November	... 16 per cent
December	... 43 ,,
January	... 17 ,,
February	... 19 ,,
March	... 5 ,,

After the Common Teal, the Pintail is probably the most numerous visitor to Manipur. But, as Baker[1] points out, 'they are extremely shy, wary birds', and it is this quality which brings them as low as eighth in the bag, with a percentage of only 6.14 per cent. The best year's bag is 970 in 1929-30, but this is unusually high, the next best being 464. Good days were:—

23-2-28	... 110
1-12-29	... 110
27-12-29	... 93
20-2-30	... 90
15-12-29	... 77
10-12-27	... 76

Baker[2] comments on the fact that the Pintail sometimes occurs in huge flocks. Such flocks, numbering at least a thousand, are frequently found on the Loktak lake and on such of the smaller *bils* as happen to attract them at various periods in the cold weather. It is also a common thing to see line after line of Pintails, each flock numbering several hundred individuals, fly in from their night feeding-grounds to the *bils*, at a height that is well out of shot. But although the Pintail is shy, a high swift flyer, and extremely quick to notice the least movement in a butt and to change his direction to avoid it, should the sportsman have the good fortune to have his butt built in some corner where the birds wish to settle, they will return to it again and again. Owing to this characteristic, Colonel Goodall shot 101 on December 1st, 1929, and I shot 60 on December 15th, 1929.

The Garganey or Blue-winged Teal (*Querquedula querquedula*) —Manipuri, *surit*, or *surit angoubā* ('the white teal'): also called by the Hindus *khere*, *kherlaobi* ('calling "kher" '), from their rattling note.

Baker[3] refers to the Garganey Teal as 'one of the earliest duck arrivals', while Finn[4] remarks that 'it comes in nearly or quite as early as the Common Teal'. Whether this species or the Common Teal arrives earlier has been discussed above in the note on the latter, and, as Baker[1] says, 'it is a toss up as to which first puts in an appearance'. But whereas the Common Teal makes its departure early, the Garganey migrates late, and is the only duck to remain in the valley in considerable numbers in April. In March they undoubtedly increase, the number being probably swelled by birds which halt to feed on the leaves of the *singhara* (*Trapa natans*) on their migration northwards. This species has been reported by shikaris on August 19th (1929) and shot on September 12th (1926). On April 27th, 1924, 33 were shot, and I shot one on the same date in 1929 and saw four on May 25th, 1919. I have no reason to believe, however, that the Garganey remains and breeds in Manipur. The percentages shot in the different months of the season are:—

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[1] *Indian Ducks and their Allies*, p. 183.
[2] Op. cit., p. 183.
[3] *Fauna of British India*, vol. vi, p. 441.
[4] Op. cit., p. 18.

November	... 12 per cent
December	... 25 ,,
January	... 13 ,,
February	... 17 ,,
March	... 23 ,,
April	... 10 ,,

Thus, March and April provide 33 per cent of the total bag of Garganey and only 3 per cent of the bag of Common Teal.

In point of numbers the Garganey is fourth, forming 10.32 per cent of the total bag of duck. This probably represents something approximating to its true proportion of migration. The best year's bag is 560 in 1924-25, and good days were:—

3-3-29	... 90
18-4-24	... 82
21-2-15	... 81

The bag of 82 on April 18th., 1924, was made on the Loktak by Captain Williams and myself. I recorded in my Game Book that no other migratory species were seen. It is unusual for Garganey to stay so late in such numbers.

Quoting Hume, Baker[2] refers to the Garganey as consorting in large flocks: Dewar[3] also refers to its 'large closely-packed flocks'. But in Manipur the flocks of Garganey are certainly much smaller than those of the Common Teal. Moreover, like the latter, they almost invariably pair at least a month before migrating, in spite of Baker's[4] statement that 'pairs are hardly ever seen'. Another statement of Baker's[5] which is not borne out by my experience is that the Garganey Teal are 'by no means first class divers'. I do not pretend that they rank with the Pochards in this respect. But I have found them as expert as any of the other ducks, especially in reeds and floating grass, where they avail themselves of the least cover, remaining, like Cotton Teal, with only the head out of water. Wounded birds also climb out of the water on to floating grass, like the Grey Lag, the Spotbill and the Common Teal. Finn[1] classes the Garganey as a better diver than the Common Teal, which Baker[2] admits to be no mean performer, especially in reeds. On the whole I should be inclined to agree with Finn in awarding the palm to the Garganey, but there is not much in it.

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[1] *Indian Ducks and their Allies*, p. 190.

[2] Op. cit., p. 191.

[3] Op. cit., p. 205.

[4] Op. cit., p. 191.

[5] Op. cit., p. 193.

'As to whether they are wild or tame opinions seem to differ very much', says Baker.[3] I cannot agree with him that they are one of the wildest of the duck tribe. I should class them as wilder than the Common Teal, the Spotbill, the Cotton and Whistling Teals, the Tufted and probably the white-eyed Pochard, being more difficult to approach on the water. They possess, however, the Common Teal's pleasant characteristic of charging a butt baldheaded, but to a less degree. While on the water a Garganey is tamer than the Pintail, the Gadwall, the Common Pochard, the Shoveller and the Wigeon.

Baker[4] describes the Garganey as a 'very silent bird as a rule'. But perhaps Finn[5] is nearer the mark in saying that they 'are not at all noisy birds . . . the note of the drake . . . is a sort of gurgling rattle . . . constantly uttered during courtship'. It is very commonly heard towards the end of the season and resembles nothing so much as a small boy drawing a stick rapidly across wooden palings.

Hume (and apparently Baker,[6] as he quotes him without comment) agrees with Finn[7] that the Garganey is not the equal of the Common Teal for the table. Here again I join issue: the Garganey gains condition much more rapidly than the Common Teal, and, especially towards the end of the season, possesses a thick layer of fat under the skin of the breast, which seems to provide a natural basting medium. In this it resembles the Pintail Snipe. I never hesitate to pick out a Garganey from the bag in preference to a Common Teal.

The Shoveller (*Spatula clypeata*)—Manipuri, *khārā*.

Baker[8] describes the Shoveller as 'a rather late arrival in India, not arriving in any numbers until about the end of October'. He says 'it leaves late also', while Dewar[9] says 'it arrives late and sometimes stays late'. Individuals, however, are among the very earliest arrivals. I have seen a Shoveller on September 24th (1914), and recollect my shikari reporting having seen them in August, in more than one year. The earliest recorded was shot on October 26th, 1914. At the end of the season, a few are always to be seen with the Garganeys after the other duck have left. I shot two on May 13th, 1917, and my shikari reported having seen one on June 14th, 1925. The percentages shot in the different months of the season are:—

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[1] Op. cit., p. 17.

[2] Op. cit., p. 171.

[3] Op. cit., p. 193.

[4] Op. cit., p. 194.

[5] Op. cit., p. 17.

[6] Op. cit., p. 173.

[7] Op. cit., p. 17.

[8] *Fauna of British India*, vol. vi, p. 444.

[9] Op. cit., p. 177.

November	... 14 per cent
December	... 42 ,,
January	... 16 ,,
February	... 18 ,,
March	... 10 ,,

The Shoveller does not occur in the same numbers as the Teals, Common, Tufted and White-eyed Pochards, Gadwall and Pintail. It is ninth in the bag, with a percentage of only 4.56 per cent. The best year was 1927-28, when 313 were shot. Good days were:—

24-2-29	... 55
27-12-25	... 54
27-12-27	... 48

Baker[1] and Dewar[2] comment on the fact that the Shoveller seldom appears in large flocks. I have never seen more than thirty together. They appear to feed and move largely in pairs, not only at the end of the cold weather, like many other duck, but also at the beginning. Baker[3] further remarks that it 'flies well and strongly', but I think he overstates its capacities in this respect when he says that 'it holds its own with Teal and other swift ducks'. This species is, as he points out, tame and easy of approach on the water, and appears sometimes to be attracted to a butt by curiosity. I have also noticed that the survivor of a pair sometimes flies over the butt again to look for its shot companion—a characteristic which is very common in the Spotbill and the Brahminy, and not unusual in the Grey Lag Goose.

None of the writers on ducks appear to have recorded what is one of the most noticeable characteristics of the Shoveller, namely, the creaking rustle made by its wings in rising off the water and flying. It is easy to identify the bird, even in the dark, by the noise of its flight, which far exceeds that made by other noisy flyers, such as the Garganey.

'As an edible', says Baker,[4] 'they are one of the worst of the duck tribe . . . ranking equal to the White-eye and inferior to the Whistling Teal'. This I regard as an insult to the White-eye. Dewar[5] is more correct in saying that it is, 'after the Brahminy and the Smew, the worst of the ducks for eating purposes'. I have tried the Shoveller at various times in the season, out of curiosity, and have never found it anything but definitely nasty.

The Red-crested Pochard (*Netta rufina*)—Manipuri, *irupi* ('diver'): the Manipuris call all the Pochards *irupi*, without distinction.

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[1] *Indian Ducks and their Allies*, p. 199.

[2] Op. cit., p. 179.

[3] Op. cit., p. 200.

[4] Op. cit., p. 199.

[5] Op. cit., p. 179.

A rare visitor to Manipur, only 70 of this species have been shot since 1910, forming 0.12 per cent of the total duck bag. A few are seen every year, but frequently the year's bag does not even contain one. The best year was 1922-23, when 12 were shot, and the best day's bag was 9 on December 25th., 1919. Their rarity is strange, considering that they are far from uncommon in parts of the Assam valley, only 55 miles north in an air line. In 1922-23 I assisted at the shooting of 97 in the Nowgong district, out of a total bag of about 2,000 duck.

The earliest recorded was shot on November 20th, 1913 (though I have seen them earlier), and the latest on March 24th, 1921. A single male stayed on a large tank in the Residency garden from April 17th to May 3rd, 1930.

The Pochard or Dun-bird (*Nyroca ferina ferina*)—Manipuri, *irupi* (not *thordingnam*, as in Finn:[1] *thoidingnam* is the Gadwall).

Baker[2] refers to the Common Pochard as 'one of the later ducks to arrive in India': and ascribes their departure in the North to 'the third week of March or early in April'.[3] In Manipur, the main body arrives late in November or early in December, and leaves about the middle of March. The earliest shot was bagged on October 26th (1914), and the latest on April 14th (1926). I saw several on April 27th, 1924. The percentages shot in the various months of the season are:—

November ...	8 per cent
December ...	37 ,,
January ...	22 ,,
February ...	23 ,,
March ...	10 ,,

Baker[4] says of the Pochard that it is 'common in Manipur'. This is true, especially in December, January and February on the Loktak lake, where they find the surroundings which he describes as peculiarly suited to them—'a huge lake, covered in part with jungle and in part having open expanses of water of some depth, free of vegetation of a heavy character'. This species is seventh in the total bag, with a percentage of 6.26 per cent. The best year's bag is 330, in 1926-27, and good days were:—

27-12-25 ...	120
24-2-29 ...	104
14-12-30 ...	100
27-12-27 ...	99

Millais[5] says of the Pochard 'they are not more or less difficult to kill than other diving ducks'. He can never have been in a butt on a cold, foggy morning, with line after line of Pochard travelling over at full speed and pretty high up. Their bullet heads, bull necks and dense plumage make them extremely hard to bring down, unless hit well forward. When brought down, as Finn[1] says, 'winged birds will give plenty of trouble to bring to book'. They possess extraordinary vitality, and a Pochard, hit in the head, will often dive and remain under water for an appreciable time, even in extremis. Others, apparently moribund, will suddenly come to life and either fly or swim away, or dive and make their way to cover. This characteristic is shared to a less degree by the other Pochards, and it is a safe rule to give another barrel to any wounded Pochard on the water which raises his head. You will doubtless waste a few cartridges: but you will put in the bag a far greater number of birds which would otherwise have escaped. They are magnificent divers, though the Tufted Pochard probably surpasses them in dodging to and fro in open water. But a winged Common Pochard will frequently disappear immediately it hits the water, and, if there are any reeds or grass within 50 yards, will never be seen again. Wounded birds are wonderfully quick at making their way to the nearest reeds or grass, and in Manipur, where much of the water weed consists of floating masses of matted vegetation, they, like the other Pochards, have the disconcerting habit of diving under the mass and disappearing entirely. Presumably they are drowned. Another habit the Pochards possess in common with other ducks, especially the Teals and Shoveller, but make more use of, is swimming when wounded with the body low in the water and the head and neck stretched out horizontally in front, along the surface of the water. In this position they are extremely difficult to kill.

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[1] Op. cit., p. 28: the error is repeated by Dewar (op. cit., p. 119), and by Baker, in the *Fauna of British India*, vol. vi, p. 450.

[2] *Indian Ducks and their Allies*, p. 219.

[3] *Fauna of British India*, vol. vi, p. 452.

[4] *Indian Ducks and their Allies*, p. 219.

[5] *British Diving Ducks*, vol. i, p. 27.

All the authorities agree that the Dun-bird is *facile princeps* among the Pochard tribe on the table. This is correct: but I think Millais[2] ranks it too high, at any rate as far as the Indian bird is concerned, when he says 'there is a tenderness and delicacy about the flesh that renders it highly popular with the gourmand'. To my mind, it cannot compare with the Garganey and Common Teal, the Spotbill, Mallard, Gadwall or Pintail. However, he is talking of the American bird, and possibly the diet of wild celery, which it shares with its relative, the Canvas-back, may make all the difference in its favour.

The White-eyed Pochard (*Nyroca rufa rufa*)—Manipuri, *irupi.*

Baker and Finn are silent as to when the White-eye invades India. Dewar[3] says that they 'arrive in the plains of India in the latter part of October and leave us in March'. This is more or less true of Manipur: but they appear to be eariler arrivals than the rest of the Pochards. The first recorded was shot on October 13th (1913), while my shikari reported their arrival as early as September 16th, in 1929. I shot one and saw several on April 27th, 1924, which is the latest record. The main body undoubtedly arrives earlier and leaves earlier than the Tufted and Common

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[1] Op. cit., p. 27. [2] Op. cit., p. 28. [3] Op. cit., p. 125.

Pochards. They breed freely in Kashmir and were suspected by Hume of breeding in the plains of India, though this does not appear to have been confirmed. But certainly none breed in Manipur. The percentages shot in the different months of the season are:—

November	...	26 per cent
December	...	41 ,,
January	...	14 ,,
February	...	12 ,,
March	...	7 ,,

Baker[1] refers to the White-eye as 'one of our most common Indian ducks', qualifying this statement elsewhere[2] by saying that 'in India the White-eye is extremely common over the northern portion, though it becomes less so to the east of longitude 9° (90° ?), being still found, however, in considerable numbers throughout Assam, Manipur, Cachar, Sylhet, Chittagong and South Burmah'. In Manipur, certainly, it is plentiful, especially in the first half of the cold weather, and its numbers are probably correctly reflected by its position in the bag, namely, fifth with a percentage of 6.56 per cent. The best year's bag is 457, in 1926-27, and good days were:—

16-12-28	...	66
24-11-27	...	62
25-1-31	...	60
20-12-25	...	48

Baker[3] states that 'the kind of water preferred by the Pochard is that also which forms the favourite resort of the White-eyed Pochard'. But Finn[4] is nearer the mark when he says that the White-eye 'likes cover'. In Manipur the Common Pochards are nearly always to be found in open water and especially frequent the Loktak lake. White-eyes, on the other hand, are almost always found in small pools inside or along the edges of the large masses of floating grass and weed, which are found on the Manipur lakes.

Most of the authorities condemn the White-eye as a table bird, though there is some difference of opinion on this point. No one would pretend that any of the Pochards compare with the Teals and the aristocrats of the table, such as the Mallard. But I have found the White-eye far from bad, and Dewar[5] hits off the situation when he says 'it is not a particularly good duck . . . but I have eaten many and am of opinion that their flesh is not nearly so inferior as some people allege'.

The Eastern White-eye (*Nyroca rufa baeri*)—Manipuri, *irupi.*

Baker[6] mentions the Eastern White-eye as having been 'shot in Manipur'. It is, as a matter of fact, a very regular though uncommon visitor. Since it was first noticed, in 1913, 51 have been shot and it has occurred yearly in the bag for the past nine years. The earliest recorded was shot on December 4th, 1927, and the latest on March 15th, 1913. The best year's bag was 12, in 1925-26.

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[1] *Fauna of British India*, vol. vi, p. 454.

[2] *Indian Ducks and their Allies*, p. 228.

[3] Op. cit., p. 229.

[4] Op. cit., p. 29.

[5] Op. cit., p. 126.

[6] *Fauna of British India*, vol. vi, p. 455.

It is not unlikely that more are shot than are recorded, being classified as *N. r. rufa.*

The Scaup (*Nyroca marila marila*).

As might be expected from its rarity elsewhere in India, this species has only been shot twice in Manipur. A female was shot on January 25th, 1925, by Captain L. Gamble, 4th Gurkha Rifles, and a male on December 27th, 1927, by Mr. J.P. Mills, I.C.S. The identification of the former was confirmed by the Society. My shikari reported having seen one on November 23rd, 1927.

The Tufted Pochard (*Nyroca fuligula fuligula*)—Manipuri, *irupi.*

The authorities say nothing regarding the times of migration of this species. In Manipur it arrives in large numbers a little later than the White-eyed Pochard and before the Common Pochard, and remains later than any duck except the Garganey Teal. The first recorded was shot on October 26th, 1914, and the last on April 27th, 1924. My shikari reported having seen them on September 24th, 1926, and I myself saw some on September 29th, 1912. I also saw one on May 17th, 1930, and on May 25th, 1919, and my shikari reported having seen one on June 14th, 1925. The percentages shot during the various months of the season are:—

November	...	11 per cent
December	...	29 ,,
January	...	17 ,,
February	...	18 ,,
March	...	25 ,,

Early writers appear to have had little accurate information as to the distribution of this species in eastern India. Baker[1] quotes Hume as saying 'Damant records it and Godwin-Austen's people procured it from Manipur: but I have no information of its occurrence east of the Brahmapootra, whether in Assam, Kachar, Sylhet, Tipperah, Chittagong or any portion of British Burmah'. On the other hand, Oates[2] says, 'we have no definite information . . . till we come to Manipur, where Mr. Hume observed it to be very abundant . . . it may, I think, be said to be common over almost every part of Upper Burma'. Hopwood,[3] however, refers to the Tufted Pochard as 'occasionally met with' in the Chindwin River districts. Baker[4] at first wrote that it is not common . . . throughout Assam', but subsequently modified his opinion,[1] to the effect that it is 'very common in Assam'. In Manipur only the Common Teal and the Pintail exceed the Tufted Pochard in numbers, and it takes second place in the total bag, with a percentage of 15.29. It is strange, therefore, that it should be only occasionally met with in the Upper Chindwin district, immediately to the east of the State. The best year's bag is 980, in 1927-28, and good days were:—

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[1] *Indian Ducks and their Allies,* p. 240.

[2] Op. cit., p. 349.

[3] *Journal of the Bombay Natural History Society,* vol. xviii, 2, p. 433, 'A Further List of Birds from the Chindwin'.

[4] Op. cit., p. 241.

6-3-32	... 233
13-3-20	... 148
27-12-25	... 116
16-3-15	... 115
20-2-28	... 109
27-12-27	... 108
15-3-28	... 108

It will be noticed that five of these large bags were made late in the season, and that 60 per cent of the Tufted Pochard bagged are shot after January 1st, as against only 33 per cent of the White-eyed Pochard.

The authorities differ as to the flight of the Tufted Pochard. Oates[2] quotes Hume as saying, 'this species has an easier, smoother and more rapid flight than most of the other Pochards, and rises much more rapidly, with less fluster than these; but still, like these, it strikes the water once or twice with its feet'. Baker[3] says, 'it rises with less fluster, noise and splashing than is caused by the rising of other Pochards, and also gets off the water more quickly'. Finn[4] says that the Tufter gets 'sharply off the water'. Dewar,[5] on the other hand, says that he has not noticed it to be 'exceptionally fast on the wing'. Millais[6] says that it 'rises . . . with considerable splashing and some noise'. My experience is that this species rises noisily and awkwardly—much more so than the White-eyed Pochard, which leaves the water cleanly, though almost invariably with a loud alarm call. As regards beating with the feet and splashing, there is little to choose between the Tufted and Common Pochards.

Again the authorities differ as to the tameness or the reverse of the Tufter. Oates[7] quotes Hume's remark that they 'swim and dive' in front of a boat and occasionally dive instead of flying when a shot is fired. Baker[8] says, 'however abundant it may be, the Tufted Pochard does not, as a rule, form a very large portion of a bag in a day's shoot. This is due to the difficulty, first in approaching the birds—for they are decidedly wild and shy—and secondly in getting a shot when once one has got within reach. If the bird does not escape at once by diving, swimming or flight, it is sure to dive before the sportsman has time to get a shot'.

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[1] *Fauna of British India*, vol. vi, p. 459.
[2] Op. cit., p. 352.
[3] *Indian Ducks and their Allies*, p. 242.
[4] Op. cit., p. 33.
[5] Op. cit., p. 134.
[6] Op. cit., p. 55.
[7] Op. cit., p. 352.
[8] Op. cit., p. 242.

Finn[1] says 'sometimes a flock will prefer to dive rather than fly'. Dewar[2] says he has not noticed that it is 'exceptionally wary . . . but . . . many individuals dive and swim under water to escape the sportsman, instead of flying'. Millais[3] says, 'on the whole the Tufted Pochard is not very easy to shoot on large sheets of water . . . when little disturbed it is possible to sail within gunshot of a flock on the open water'. But he also notes[4] that they are 'not as a rule very shy birds', and remarks on their tendency to swim away at a considerable pace when alarmed. In Manipur the Tufted Pochard is certainly not a wary bird, on the wing or in the water. They can commonly be approached within shot in a boat. As Hume and Millais have remarked, they swim away in front of the boat and are usually the last to take to flight, when the fact that they are easy to bring down generally results in one or two being left behind, though it will usually be found that one at least is a diver and needs another shot to finish it off. On March 13th, 1930, when a bag of 274 duck on the Loktak lake contained 148 Tufted Pochards, and the birds kept to the open water and refused to fly over the butts, Rajkumar Bhaskar Singh, nephew of His Highness the Maharaja, left his butt early and bagged 136 duck, of which the majority were Tufters, shot on the open water. As regards their diving when approached or fired at, I have noticed that this is only the case when they are taken by surprise, as when a boat comes upon them suddenly round the corner of a bed of reeds. When approached direct in open water, they first swim away and eventually all take to flight. Wounded birds always dive, with very considerable skill and cunning. They share with the other Pochards the tendency noted above in the Common Pochard, of making for the nearest cover and disappearing under a floating mass of matted grass or weeds.

Baker[5] condemns the Tufted Pochard as 'a poor article of food'. But Finn[6] classifies it as 'often good eating' and Hume passes them as 'good enough'. They, like the White-eyed Pochard, are not to be despised when better duck are not available, and are undoubtedly superior to Whistling Teal, Brahminy and Shoveller. Personally, I prefer them to Wigeon.

On December 2nd, 1928, Colonel Goodall shot an albino Tufted Pochard, the dark parts of which were a pale brownish-buff. The identification was confirmed by the Society.

The Golden-eye (*Glaucionetta clangula clangula*).

Only one specimen is recorded, shot on December 17th, 1922, and identified by the Society.

The Eastern Goosander (*Mergus merganser orientalis*).

A single female, shot in the north-east of the Manipur valley on a small *bil* at the foot of the hills, was brought in to me on February 29th, 1928. I identified it with the help of Baker's *Indian Ducks and their Allies* (First Edition), which does not differentiate between *Mergus merganser merganser* and *M. m. orientalis*, but it probably belonged to the latter subspecies. I have never seen any of the Merginae in Manipur, which is, perhaps, strange in a country so hilly.

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[1] Op. cit., p. 33.

[2] Op. cit., p. 134.

[3] Op. cit., p. 62.

[4] Op. cit., p. 56.

[5] Op. cit., p. 243.

[6] Op. cit., p. 34.

HYBRID DUCK.

Four have been recorded:—

1. ***Mallard + Shoveller.*** A bird with the typical green head and certain of the characteristic body markings of both species, and with a slightly spatulate bill. It was shot on March 16th, 1915, by Captain A. C. Norman, 5th Cavalry, and the identification was confirmed by the Society.

2. ***Common Pochard + Tufted Pochard,*** shot on January 6th, 1924. I never saw this bird, and it is just possible that it may have been a female Scaup, or a female of one of the two species with some peculiarity of plumage, as the identification was never confirmed. But Millais[1] says that 'a great number of hybrids between the Tufted Pochard and other ducks have been recorded, and the cross with the Common Pochard seems to be the most common'.

3. ***Bronze-capped Teal + Wigeon.*** A bird with many of the characteristics of the males of each species. It was shot on December 20th, 1925, by Captain Williams, the identification being confirmed by Mr. Stuart Baker.

4. ***Bronze-capped Teal + Gadwall.*** In this bird the plumage of the body, the legs, the beak and the eyes were in no way different from those of a Gadwall drake, but the whole of the chin, throat and foreneck were light chestnut, and the crown and nape bronze. I shot it on December 11th, 1930, and sent the skin of the head and neck, with a description of the whole bird, to the Society, where it was identified by an Assistant as an immature *Eunetta falcata*. This it most certainly was not, being a typical drake Gadwall, but for the plumage of the head and neck. I have no doubt whatever that it was a hybrid between the two species named above.

(To be continued).

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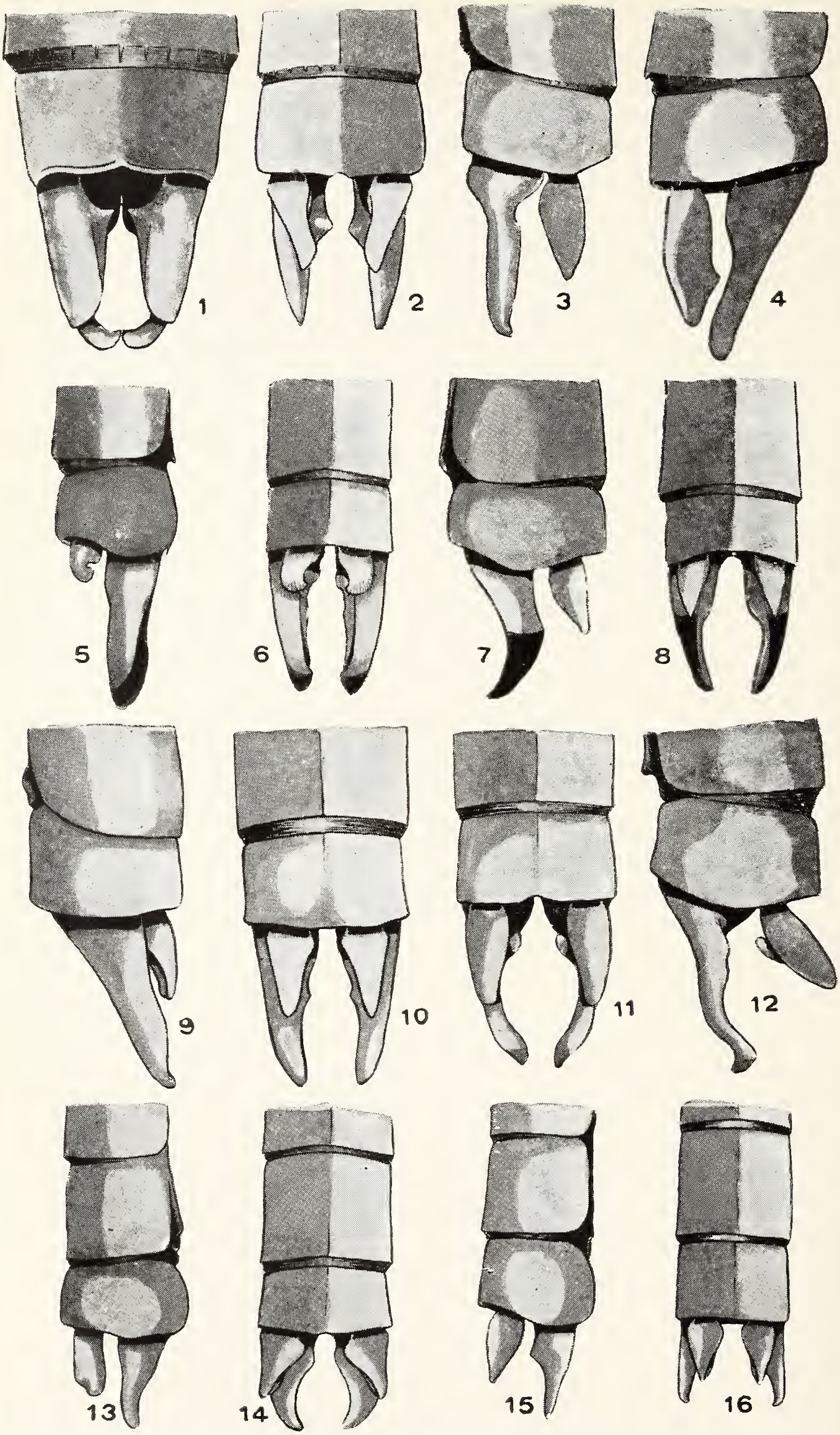
[1] Op. cit., p. 63.

INDIAN DRAGONFLIES.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Anal appendages of Dragonflies. (For explanation of plate see end of article.)

INDIAN DRAGONFLIES.[1]

BY

F. C. FRASER, LT.-COL., I.M.S., F.E.S.

PART XLI.

(*With 2 plates and 2 text-figures*).

(*Continued from page* 151 *of this volume*).

Genus: COPERA Kirby (1890).

Platycnemis pars Ramb. Ins. Névrop. p. 240 (1842).
Psilocnemis Selys, Bull. Acad. Belg. (2) xvi, p. 163 (1863); Id. Mem. Cour. xxxviii, p. 121 (1886); Laid. Fascic. Malay. (Odon), Part II, p. 7 (1907).
Copera Kirby, Cat. Odon. p. 129 (1890); Laid. Rec. Ind. Mus. Vol. xiii, p. 336 (1917); Munz, Mem. Amer. Soc. Ent. No. 3, p. 54 (1919); Fras. Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 744 (1923); Id. ibid. Vol. xxxv, p. 646 (1932).
Pseudocopera Fras., Mem. Dept. Agric. India (Ent.) No. 7, Vol. vii, p. 56 (1923).

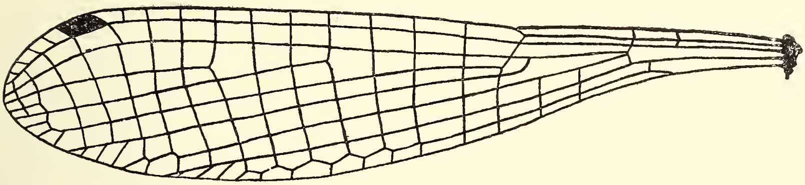

FIG. 1.—Wing of *Copera marginipes* (Ramb.)

Zygopterous dragonflies of small size and rather slender build, with abdomen less than twice the length of hindwings, coloured variably black or brown with intricate or simple markings in white, yellow or pale brown, less commonly in pale blue, tenerals and sub-adults pure white with black markings which gradually obscure the white background as the insect becomes fully adult; wings hyaline, moderately rounded at apices, never falcate, petiolated to the level of the proximal antenodal nervure; discoidal cell elongate, with costal and posterior sides nearly equal in length, distal side about half as long again as the basal so that the cell gradually dilates distad; sectors of arc arising from lower end of arc and markedly divergent from origin; no accessory basal postcostal nervures present; *Ac* situated about midway between the two antenodal nervures; *Ab* always present and complete, continued on as *IA* which extends for about the basal half of wings; *Cuii* extending about 5 to 6 cells beyond the end of *IA*, about 12 cells in length; *Riv+v* arising well proximal of the level of subnode; *IRiii* at the level of the oblique nervure descending from it; pterostigma small, very oblique, diamond-shaped, braced, covering about 1 cell; cells of wings mainly quadrangular; 2 cells between the discoidal cell and the nervure descending from the subnode.

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[1] Mr. D. E. Kimmins of the British Museum has called my attention to what he believes to be an important error in Part XXXIX of this series, one however which is more apparent than real.

Dr. Laidlaw's Revision of the genus *Coeliccia* was published in the Records of the Indian Museum in the month of March 1932, whereas my paper (Part XXXIX) dealing with the same genus, appeared in the previous month of the same year. The authorship of the species *C. vacca*, *loringae*, *loogali* and *fraseri* ascribed to Laidlaw, would therefore appear to belong to myself by the laws of priority. As a matter of fact Dr. Laidlaw's MS. containing the descriptions of these species, passed through my hands and was forwarded to the Editor of the Records by myself personally long before my own paper was completed and sent for publication. Delay in the publication of the Records led to my paper appearing first; this should be perfectly clear from the synonymy given in my paper which gives the MS. as in possession of the Editor of the Records and shows that it was actually received for publication in the year 1931. The authorship of these species clearly belongs to Dr. Laidlaw.

F. C. FRASER.

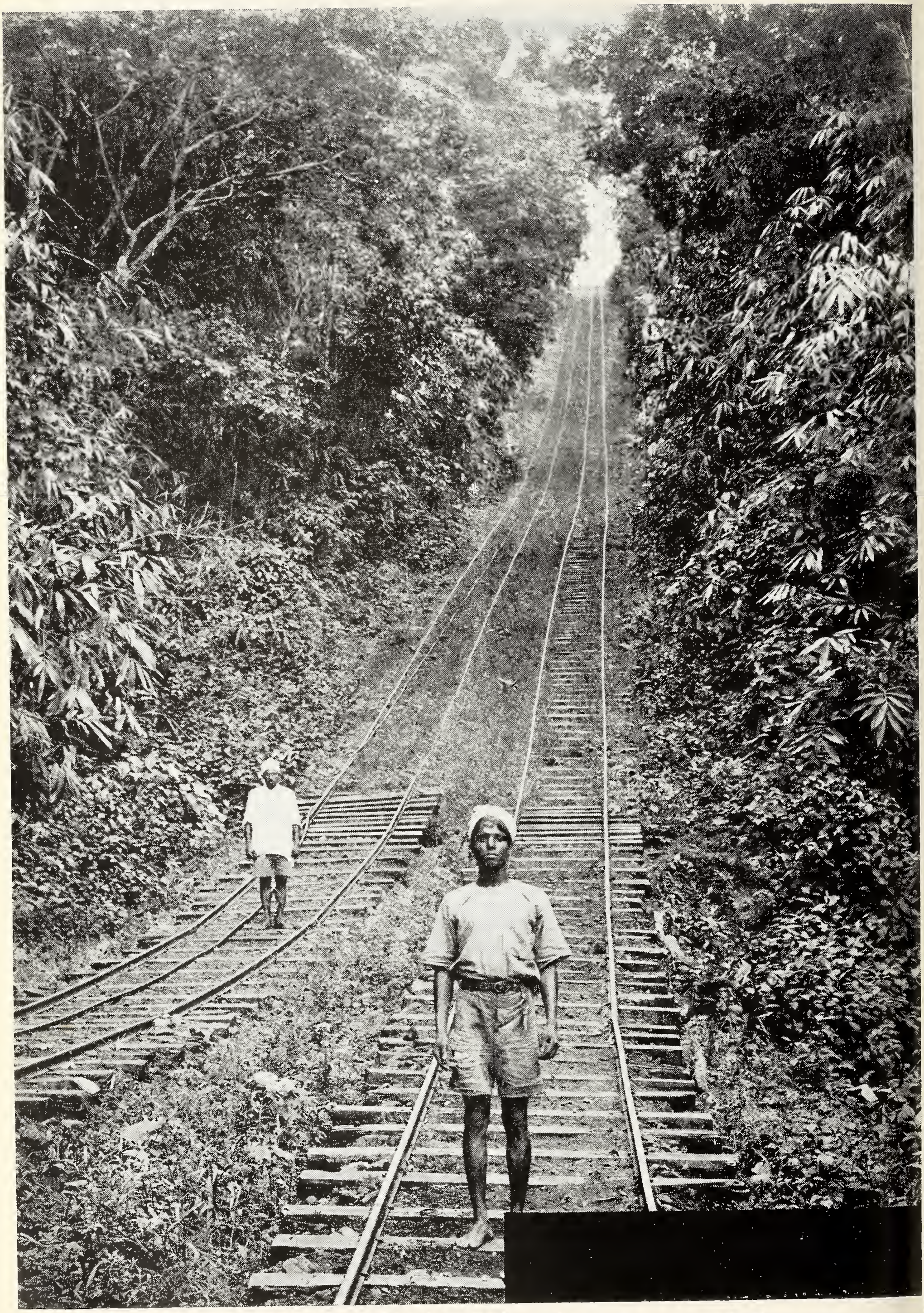
Head narrow, eyes smaller than in species of *Platysticta;* 2nd segment of antennae as long as or longer than 3rd., occiput simple, deeply hollowed out behind; prothorax with posterior lobe simple rounded and without appendages in both sexes; thorax and abdomen moderately robust, the latter cylindrical, very slim and long, dilated somewhat at the terminal segments, of even thickness in the females; anal appendages variable in the species, superiors usually considerably shorter than the inferiors.

Genitalia.—lamina deeply and narrowly cleft; hamules broad quadrate plates meeting across the middle line; penis with apical end curled up but not bifurcated at end, furnished on each side with long curling branches directed somewhat backwards and outwards; lobe flask-shaped. Legs in the males with the tibiae broadly or very broadly dilated except in a few species; females differing rather broadly from the males in colour, shape and markings; vulvar scales rather short and never extending beyond end of abdomen.

Genotype: *Copera marginipes* (Ramb.).

Key to species of Genus COPERA.

1.	The two hind pairs of tibiae white and widely dilated	... ... 2.
	The two hind pairs of tibiae yellow, reddish or brown, only moderately dilated ...	... ... 3.
2.	Legs very long, hind femora extending nearly to end of segment 2; 2nd abdominal segment wholly black on dorsum; inferior anal appendages strongly arched downwards, black at apices	*C. annulata* Selys.
	Legs short, hind femora extending only to end of thorax; 2nd abdominal segment with 2 dorsal blue spots; inferior anal appendages quite straight, white at apices	*C. superplatypes* Fras.
3.	Superior anal appendages one-fourth the length of inferiors	*C. marginipes* (Ramb).
	Superior anal appendages at least half the length of inferiors	... ... 4.
4.	Legs very long, tibiae not dilated, brownish; posterior lobe of prothorax of female without spines	*C. assamensis* Laid.
	Legs shorter, tibiae slightly dilated, citron yellow or brick-red; posterior lobe of prothorax of female with a pair of divergent, forwardly directed spines ...	*C. vittata* Selys.



The forest cable tram line, Kavalai, Cochin State. *Copera marginipes* and *Copera annulata* are found in the dark shady jungle bordering the line, whilst *Platysticta deccanensis* is found on small streams bordering the line.

Copera marginipes (Ramb.).

Platycnemis marginipes Ramb., Ins. Nérop. p. 240 (1842).
Psilocnemis marginipes Selys, Bull. Acad. Belg. (2), xvi, p. 168 (1863); Id. Mem. Cour. xxxviii, p. 127 (1886); Krug. Stett. Ent. Zeit. p. 102 (1898); Selys. Ann. Mus. Civ. Genov. (2) x, xxxii, p. 501 (1891).
Psilocnemis striatipes Selys, Bull. Acad. Belg. (2), xvi, p. 169 (1863).
Platyenemis lacteola Selys, Bull. Acad. Belg. (2), xvi, p. 167 (1863).
Copera marginipes Kirby, Cat. Odon. p. 129 (1890); Id. Journ. Linn. Soc. Zool. Vol. xxiv, p. 560 (1894); Mart. Mission Pavie, p. 18 (sep.) (1904); Laid. Fascic. Malay. (Odonata) Part ii, p. 8 (1909); Ris. Suppl. Ent. No. v, p. 18 (1916); Laid. Rec. Ind. Mus., Vol. xiii, pp. 322, 337, Pl. xiv, fig. 2 (1917); Fras. Journ. Bom. Nat. Hist. Soc. Vol. xxvii, p. 543 (1921); Id. ibid. Vol. xxix, p. 744 (1923); Id. Rec. Ind. Mus. Vol. xxvi, pp. 428, 498 (1924); Laid. Spolia Mentaw. (Odonata) Journ. Malay. Br. Roy. Asiatic Soc. Part ii, pp. 218-230 (1926); Fras. Rec. Ind. Mus. Vol. xxxiii, p. 448 (1931).

Male.—Abdomen 28-31 mm. Hindwing 16-18 mm.

Head.—Labium pale brown; labrum, bases of mandibles, genae, ante- and post-clypeus pale greenish yellow, the latter with a small black spot on each side of the middle line; frons and vertex with a broad bronzed black fascia extending from eye to eye followed by a broad greenish white or bluish stripe equally wide, which wraps round the sides of the posterior ocelli and runs back as a narrow bordering to each eye to become nearly confluent with a narrow similarly coloured stripe which traverses the occiput behind the eyes; these two pale stripes enclosing a broadly elliptical stripe on occiput; eyes black above, greenish at sides and below and with a narrow equatorial black band circumventing them and confluent with the black stripe traversing the vertex; beneath occiput broadly greenish white from the eyes inwards.

Prothorax bronzed black on dorsum and lower part of sides which are traversed by a broad pale greenish yellow stripe invaded at two points by the dorsal black; lower border narrowly pale yellow; posterior border very finely yellow, this lobe shallow and very broadly rounded.

Thorax bronzed black on dorsum for rather more than halfway to the humeral suture, the middorsal carina and border of antealar sinus very finely bordered with yellow; a narrow pale greenish yellow antehumeral stripe in continuation of the lateral prothoracic one and bifurcated above by a small black upper humeral spot; this stripe followed by a broad black fascia narrowing above and stippled on the middle of mesepimeron with tiny yellow spots; the sides beyond this pale greenish yellow as well as below thorax, marked with an irregular black stripe on the anterior border of the postero-lateral suture and a second curved and narrower black stripe on the middle portion of metepimeron.

Legs variably bright orange to dull reddish ochreous, the posterior two pairs of tibiae moderately broadly dilated and about equal in length to the femora.

Wings hyaline; pterostigma pale brown with a fine frame of yellow and thick black nervures, covering 1 cell, poorly braced; 12 postnodal nervures to forewings, 9 in the hind; 5 cells after the pterostigma between costa and radius.

Abdomen bronzed black as far as the middle third of segment 8 from which segment to the end of abdomen is pale bluish white or pale creamy white according to age; segment 1 with the apical border narrowly and the sides broadly pale greenish white but the latter bearing a short dark stripe; segment 2 with a narrow middorsal pale greenish white stripe not quite extending to apical border, the sides of this segment also pale, clouded with brownish; segments 3 to 6 with a pale stripe along the sides confluent with a narrow pale green white annule at the base of each segment; lower border of segment 9 and the basal third of 8 narrowly black.

Anal appendages pale yellow to white, inferiors tipped with black beneath. Superiors half the length of segment 10, vestigial, tiny rounded tubercles with the apex pointed and hooked strongly ventrad; inferiors at least four times as long as the superiors, broad at base, tapering but slightly to a rounded obtuse apex, slightly separated at base, apices sloping inwards and finally meeting, inner surfaces rounded or hollowed out.

Female.—Abdomen 29-30 mm. Hindwing 20 mm.

Differs from the male in several respects.—the abdomen more robust and cylindrical, the ground-colour is drab and varying shades of brown, whilst the darker and black markings are more restricted.

Head.—Labrum with a tiny medial point of black at base; genae, bases of mandibles and clypeus palest brown, the latter with the same two black points seen in the male; frons warm brown; the broad black fascia on vertex replaced by a broken black line which broadens into a large black spot against the eyes; 2nd segment of antennae and distal end of 3rd creamy white; rest of upper surface of head and occiput pale brown or fawn marked with a narrow interrupted black stripe just behind ocelli, not extending out as far as eyes, and a second longer, equally narrow black stripe on occiput behind eyes; beneath head dirty white; eyes similar to the male but the polar cap dark olivaceous brown.

Prothorax and thorax violaceous brown on dorsum with a similar bronzed black fascia on middorsum as seen in the male, pale brown laterally with the black markings largely obsolete, the upper humeral spot present but the posthumeral black stripe reduced to a lower zigzagged marking, whilst the stripes on the postero-lateral suture and metepimeron are mere black lines. Posterior lobe of prothorax deeply notched, a small triangular lobe arising from the centre of notch and projecting forwards slightly to overlap the middle lobe.

Legs brownish white or carneous; femora with a speckled band or longitudinal black stripe running the whole length of their outer sides, most conspicuous on the hinder pair; tibiae undilated.

Wings similar to the male; 12 to 13 postnodal nervures to forewings, 11 in the hind; pterostigma slightly paler and more elongate.

Abdomen warm brown on dorsum deepening to broad black apical annules on segments 3 to 6 and the greater part of 7; markings on segments 1 to 7 similar to the male; apical half of segment 8 and the whole of 9 and 10 pale brownish white or creamy white in sub-adults. Anal appendages shorter than segment 10, pale brownish white; vulvar scale brown, barely reaching end of abdomen.

Distribution.—This, the commonest species of the genus is widely distributed throughout southern Asia and the Sondaic Archipelago. The type, which I have been unable to examine, is from Java and formed part of the old Serville collection and is now, I believe, incorporated in the Selysian collection. Java specimens resemble those from Siam and Burma, the above description being made from one from the latter country. The species shows an infinite number of varieties, not only according to the age of the specimens, tenerals being white with a few scanty black markings, but also according to the locality of origin. Unfortunately even in the latter, varieties crop up so that it is difficult to say that a number of races exist. It seems safer with our present knowledge and material, to classify them all as mere varieties of one species. Several species however have been described which appear to me to be of no greater value than varieties. Among these is *C. acutimargo* Kruger, recorded by Laidlaw from Mergui, Lower Burma. I possess specimens taken in the same locality, but after careful comparison, am unable to appreciate sufficient differences to separate them from specimens from Western India, which I have valued as mere varieties of *C. marginipes.* All of these differ from the Burmese form by segment 8 which is entirely black.

Ceylon forms.—Abdomen 34 mm. Hindwing 18 mm.

Usually long and slender abdomen, almost double the length of hindwing; postclypeus and frons black forming a continuous black area with the vertex as far back as the level of the antennae; 2nd and 3rd segments of antennae black tipped with white; the broad black fascia on occiput divided transversely into two stripes, a broad one anteriorly shaped like the propeller of an aeroplane, and a narrow one lying well behind the former. Lateral markings of thorax much reduced, the post-humeral stripe only present below and broken up into tiny spots above; the stripes on the postero-lateral suture and metepimeron absent. Legs bright brick-red. Wings with 13 and 11 postnodal nervures respectively; pterostigma black framed finely in yellow.

Abdomen black above on segments 3 to 8 with sharply defined pale blue annules on segments 3 to 7, very narrow on the latter; segment 2 has the pale middorsal stripe heavily bordered with black on each side and there is an apical annule the ends of which tend to encircle the ends of the stripes;

segment 8 has the apical border and a small diamond-shaped apical spot pale blue, whilst segments 9 and 10 and the anal appendages are entirely pale blue, only the extreme tip of the latter being black, whilst their shape does not differ from type.

Female.—Abdomen 30 mm. Hindwing 18 to 19 mm.

Labrum and bases of mandibles bright yellow; postclypeus with the black spots larger; black stripe on front of vertex more reduced; 2nd segment of antennae only pale coloured; occiput black except for a mere vestige of a postocular stripe.

Posterior lobe of prothorax with the middle lobe longer and the lateral forming small rounded lobes recurved forwards. The dark stripes on femora broken up into a chain of tiny black dots. Abdomen very similar to type but the black apical annules sending lateral prolongations basad which form letters of U, the arms of which embrace the medial white stripe and bordering black; segments 9 and 10 and anal appendages creamy white. (Described from a pair taken *in cop* at Kandy, 2,000 ft. during August.)

Coorg forms.—Male.—Abdomen 32 mm. Hindwing 18 mm.

Black markings on head more extensive, the postclypeus, frons and vertex forming one confluent area, the pale stripe separating this area from the occiput very narrow and almost obsolete, the dark areas of occiput extending out as far as the eyes, markedly bronzed, almost dark green metallic; the post-orbital stripe very broad.

Prothorax and thorax with equally extensive melanism, the former with a very narrow lateral stripe only, the middorsal bronzed area extending out as far as the humeral suture above and nearly as far below; the post-humeral stripe extending broadly upwards as far as base of wings and enclosing with the dorsal black a narrow pale humeral stripe which traverses the humeral suture obliquely from below upwards; the black stripe on the sides more extensive and made up of stippled spots irregularly confluent.

Legs bright brick-red, the tibiae moderately dilated. Wings with 12 to 14 postnodal nervures and 11 to 12 respectively; a very narrow pterostigma almost twice as long as broad, dark reddish brown finely framed in pale brown. Abdomen and anal appendages similar to the Ceylon forms but the inferior appendages palely ochreous.

West Coast forms.—These are intermediate between the forms described from Coorg and the type and come mainly from Mahableshwar and the ghats near Bombay. The pattern of the black markings on head shows much variation but the pale stripe traversing vertex is moderately broad in all and the black occipital fascia falls just short of the eyes; postclypeal markings vary from large spots to entire blackness; pterostigma long and narrow as in Coorg forms; segment 9 with its sides, especially at the basal end broadly black; inferior anal appendages black as far as base on the outer sides.

Deccani forms.—Abdomen 26 mm. Hindwing 14 mm.

These are from Poona, and Mhow, C.P., and show a marked reduction of melanism, especially in the females, the heads of which are entirely without black markings and wholly pale khaki brown. Males from the Central Provinces have the postclypeus unmarked and the frons narrowly bordered with pale brown in front; the occipital black markings are reduced to two large pyriform spots finely united by a median black line, the postorbital stripe being nearly obsolete. The lateral markings of thorax obsolete save for the lower part of the post-humeral marking. Legs carneous. Pterostigma markedly narrowed. They represent the smallest forms of the species and their pale colour is the outcome of their semi-desert surroundings.

In addition to the absence of black head markings in the female, the lateral markings of thorax are obsolete and the middorsal bronzed area very narrow; markings on abdomen reduced to a mere middorsal dark brown stripe extending as far as segment 8, whilst 9 has two subdorsal basal streaks and 10 is unmarked. The posterior lobe of prothorax shaped as for type. Wings in adults deeply enfumed.

Assam forms.—Males closely resemble those from the West Coast, whilst the females have the dark stripes on head broken up into isolated bronzed green spots recalling strongly those found in *Sympycna*. The lateral thoracic markings much reduced. Posterior lobe of prothorax similar in shape to that of the Ceylon form. These are obviously dry season forms and were taken at Margherita, Assam during May.

Bengal forms.—A pair from Jalpaiguri show the black markings much reduced, the occipital markings in the male tending to be broken up into isolated spots, and in the female, represented only by tiny black points lying in a pale area. Here again modification of the posterior lobe of prothorax is found. A dry season form taken in March.

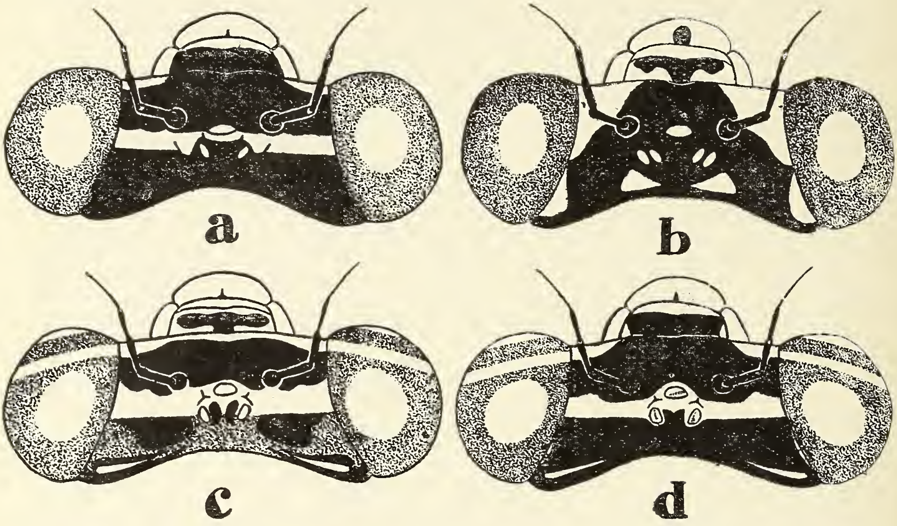


FIG. 2.—Dorsal view of heads of—(*a*) *Copera superplatypes* Fras. ♂. (*b*) *Copera annulata* (Selys) ♂. (*c*) *Copera vittata* (Selys) ♂, from Coorg. (*d*) *Copera marginipes* (Ramb) ♂, from the West Coast.

Copera vittata (Selys).

Psilocnemis vittata Selys, Bull. Acad. Belg. (2) xvi, p. 170 (1863); Id. Mem. Cour. xxxviii, p. 121 (1886).

Copera vittata Kirby, Cat. Odon. p. 129 (1890); Laid. Rec. Ind. Mus. Vol. viii, pp. 342, 343 (1914); Krug. Stett. Ent. Zeit. p. 102 (1898); Fras. Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 744 (1923); Id. Rec. Ind. Mus. Vol. xxvi, pp. 428, 498 (1924).

Copera vittata deccanensis Laid. Rec. Ind. Mus. Vol. xiii, pp. 323, 327-329 (1923); Fras. Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 744 (1923); Id. Rec. Ind. Mus. Vol. xxxiii, p. 448 (1931).

Psilocnemis serapica Selys, Bull. Acad. Belg. (2) xvi, p. 171 (1863).

Male.—Abdomen 30 to 32 mm. Hindwing 16 to 18 mm.

Head.—Labium pale reddish brown; labrum bright greenish yellow; genae and bases of mandibles pale bluish green; anteclypeus pale; postclypeus, frons and vertex black, the latter traversed from eye to eye by a moderately broad pale bluish green stripe which passes between the anterior and posterior ocelli; behind occiput a postocular narrow creamy white stripe; eyes capped above with black, olivaceous green below and with a narrow black equatorial stripe circumventing the eyes.

Prothorax black with a narrow ochreous stripe on each side; posterior lobe broadly rounded.

Thorax bronzed black on dorsum nearly as far as humeral suture, the space between the humeral and ante-lateral sutures dark chocolate brown or blackish stippled with a few coarse yellow spots, the two dark areas separated by a narrow humeral ochreous stripe; the sides posterior to the antero-lateral suture bluish or yellowish, an obscure vestigial brownish stripe anterior to the suture and a second more pronounced on the middle of metepimeron; beneath thorax yellow. Legs reddish, the two hinder pairs of tibiae very slightly dilated.

Wings hyaline; pterostigma much less elongated than in *C. membranipes*, squared outwardly, dark reddish brown, paler at its circumference, framed in black nervures, covering 1 cell, very poorly braced; 10 to 13 postnodal nervures to forewings, 10 in the hind.

Abdomen black on dorsum and laterally as far as segment 10 which latter is pale blue; segment 9 also with a small apical blue dorsal spot which sometimes extends halfway along segment towards its base; segments 3 to 7 with very narrow pale blue basal annules and with the white of ventral surface expanding subapically on to sides; segments 1 and 2 warm brown, the former with the dorsum largely black, the latter with the middorsal carina finely pale blue bordered with black.

Anal appendages.—Superiors pale blue or creamy white, as long as segment 10, conical, depressed, acute and tapered at apex; inferiors nearly twice the length of superiors, broad at base, tapering to apex and directed somewhat obliquely inwards so as to meet at apices, pale within, blackish brown externally and armed with a small obtuse spine at middle of inner border. Penis broadly blunt at apex, the apical end curled over to embrace the stem of organ, broadening at end where it is shallowly grooved to embrace the stem, the outer angles being produced into a point but not branched.

Female.—Abdomen 28-30 mm. Hindwing 18 mm.

Differs rather strongly from the male.—the abdomen much more robust and cylindrical throughout, the black markings more restricted.

Head.—Labrum bright yellow with a small medial basal black point and its base also narrowly black; genae, bases of mandibles greenish yellow; frons and vertex purplish brown with a moderately broad transverse black band extending from eye to eye at base of antennae; the transverse black fascia on occiput absent but the postocular stripe present; ocellar space paler, forming an ill-defined pale stripe; 2nd segment of antennae white, the 3rd pale brown.

Prothorax blackish brown with a pale stripe on each side; posterior lobe deeply notched with a small median lobe lying within the latter and with the angles of the lobe prolonged forwards as fine strongly divergent spines. Thorax pale brown marked very similarly to the male.—the middorsal bronzed area narrower, the middorsal carina and antealar sinus finely yellow; a large black spot on upper part of humeral suture and the suture below this finely delineated in black; the post-humeral black band very ragged and interrupted by large pale spots, extending for only two-thirds up the sides of thorax; the band bordering the postero-lateral suture very broad; two narrow stripes on metepimeron, one of which lies just posterior to the suture and is interrupted above, the other shorter and narrower bordering the thorax below. Beneath pale brown marked with three large black spots.

Legs yellow, all femora with the speckled band on extensor surfaces. Wings hyaline more or less palely enfumed; pterostigma subquadrate, shaped very much as in the male but rather shorter, blackish brown framed in yellow and black nervures, covering 1 cell, poorly braced; 14 postnodal nervures to forewings, 12 in the hind.

Abdomen dark purplish brown changing to black on segments 7 to 10; segments 1 and 2 similar to the male; segments 3 to 7 with narrow pale yellow or white basal annules; segment 9 with a broad brownish white T-shaped spot on its dorsum, whilst segment 10 is entirely of that colour except laterally. Anal appendages brownish white, conical, pointed, surmounting a large conical protuberance. Vulvar scales dark brown, robust, extending to end of abdomen.

Distribution.—Almost identical to that of *C. marginipes* if we consider all the numerous species and varieties which have been described as differing from the latter but which here are considered of not more than racial value. Colour and markings appear to have been the main reason for creating new species but as varying degrees of melanism are found even in the same locality and depend so much on the age of the specimen or the time of the year at which it occurs, wet and dry season forms undoubtedly occurring, markings are no criterion for splitting up the species. *C. atomaria* Selys, from Borneo, represents the maximum amount of melanism found in the species, whilst dry season forms from the Deccan show remarkably little of this. The author has been able to examine specimens from the West Coast of India, Coorg, Nilgiris, Anaimallai Hills, Assam, Burma, and Siam and has found an infinite variety in the markings which are often confluent or as often discrete. On the other hand none differs in the shape of the anal appendages, the legs of the male or the posterior lobe of the prothorax of female. Dr. Laidlaw has described the West Coast form as a subspecies under the name of *C. vittata deccanensis*. Although during life or in spirit, these specimens appear to be more brightly coloured than those from elsewhere, after death and dryage they become rather drab insects. Thus during life the legs of *C. vittata deccanensis* are bright citron yellow, the sides of thorax bright greenish yellow and the humeral stripes, abdominal markings and anal appendages pale blue, these colours giving place to pale browns or ochreous etc. after death. *C. serapica* Selys, from the Nicobars is most certainly a female of *C. vittata*, as the shape of the posterior lobe of prothorax at once determines it.

Males of *C. vittata* are readily determined from other species by the straight anal appendages, the superiors being half the length of the inferiors, and also by the very slight dilatation of the tibiae.

Females are most easily determined by the divergent spines on the posterior lobe of prothorax, absent in other species, and by the three black spots beneath thorax. The type is in the Selysian collection and has been erroneously described as having the labrum black. Paratypes are to be found in most national collections and a number of private ones. This species and *C. marginipes* inhabit the same spot and have identical habits; they are to be sought for in dark gullies or among the scrub of shady jungles, where the white tenerals may be seen moving about as the so-called 'Ghost forms' and have a highly characteristic sinuous flight. Adults being more cryptically coloured, are seen with greater difficulty and must be gently beaten up.

They are rarely seen over water and the act of oviposition has never been witnessed; they breed however in tiny brooks and runnels leading into larger rivers.

Copera assamensis Laidlaw.

Copera assamensis Laid. Rec. Ind. Mus. Vol. viii, pp. 342, 343 (1914); Id. ibid. Vol. xiii, p. 338 (1917).

Male.—Abdomen 32 to 34 mm. Hindwing 17 to 18 mm.

Head.—Labium palest brown; labrum yellow; bases of mandibles and genae greenish yellow; anteclypeus pale brown; postclypeus, frons and vertex black, the latter traversed from eye to eye by a moderately broad creamy white stripe at level of ocellar space; distal end of 2nd segment of antennae yellow; occiput reddish brown marked in full adults anteriorly and posteriorly by a diffuse black border and by a narrow postocular black stripe lying behind an equally narrow pale yellow stripe. Eyes dark brown above, olivaceous below and circumvented by a narrow blackish brown equatorial belt.

Prothorax brown with the posterior lobe, three short parallel stripes on middle lobe and a broad lateral stripe black.

Thorax brown or carneous marked irregularly with black as follows.—a broad bronzed black band on middorsum extending out for rather more than halfway to the humeral suture, which latter is finely delineated in black but expands into a small black spot above; middorsal carina and borders of antealar sinus finely yellow or ferruginous; on the sides a continuation of the lateral black belt seen on the prothorax which extends for a short distance on to mesepimeron and breaks up into two obscure mottled fasciae; postlateral suture finely black and a short black stripe on the metepimeron; beneath yellowish. Legs reddish or reddish brown, the tibiae undilated (Laidlaw states of the type that the hind pair only show a trace of dilatation but in the example before me I am unable to see any sign of this so that it may be variable).

Wings hyaline; pterostigma dark reddish brown framed in pale yellow and thick black nervures, the distal side nearly straight, the proximal very oblique, subquadrate, barely longer than broad, poorly braced, covering 1 cell; 13 postnodal nervures in forewings, 11 in the hind.

Abdomen black ringed with pale blue basal annules; segment 1 ochreous with a curved black stripe on each side and a short apical subdorsal black stripe; segment 2 with a pale creamy white stripe on middorsum bordered heavily with black and not extending to apical border of segment and with an apical crenate black line which embraces the ends of the dorsal pale and black stripes; segments 3 to 8 black with narrow basal blue annules and the black extending on to the sides at apex of segments to form broad apical annules; the sides of segments 3 to 6 pale; segment 9 with its basal half black or else entirely pale creamy white; segment 10 entirely this colour except laterally.

Anal appendages very similar to those of *C. vittata;* superiors creamy white, triangular as seen from above, conical and subcylindrical as seen in profile, hollowed out within; inferiors nearly twice the length of superiors, dark reddish brown, outer surface black especially towards apex, extending straight back, obtuse at apex, broad at base, subcylindrical thereafter. Penis similar to that of *C. marginipes.*

Female.—Abdomen 30 mm. Hindwing 17 mm.

Differs from the male by its more robust build, especially the abdomen which is of even width throughout, and also by the black markings more extensive. Head marked as in the male but the occiput entirely black save for the postocular pale stripes; the black fasciae on vertex rather broader. Prothorax coloured similarly to the male; posterior lobe shaped as in *C. vittata,* but without spines.

Thorax with the humeral and lateral black markings more extensive and mottled with coarse yellow spots. Wings similar to the male; legs yellowish, femora with the characteristic beaded black band on extensor surface.

Abdomen blackish brown to black on the terminal segments, the 9th and 10th bearing pale brown dorsal spots. Anal appendages pale brown, conical, pointed; vulvar scales robust, dark brown.

Distribution.—From Assam to Indo-China. The type in the Indian Museum has the upper surface of head mainly brown and with no black markings save for the transverse black stripe on vertex. A specimen from Siam in the author's collection has the markings more developed and are as described above. The male is easily distinguishable from *C. vittata* by its much longer legs without dilatation of the tibiae, this latter character separating it from all other species of the genus. The female described above by Laidlaw may not be that of *C. assamensis* as it does not differ materially from that of *C. vittata.* (Forster stated that the females of this genus were dimorphic but after examining many scores, I am unable to agree with or corroborate this; it would be more correct to say that they are polychroic according to age and season.

Copera annulata Selys.

Psilocnemis annulata Selys, Bull. Acad. Belg. (2) xvi, p. 172 (1863); Id. Mem. Cour. xxxviii, p. 124 (1886).

Psilocnemis subannulata Selys, (2) Mem. Cour. xxxviii, p. 125 (1886).

Copera subannulata Kirby, Cat. Odon. p. 129 (1890); Laid. Rec. Ind. Mus. Vol. xiii, p. 337 (1917).

Copera annulata Kirby, Cat. Odon. p. 129 (1890); Laid. Rec. Ind. Mus. Vol. viii, pp. 341, 342 (1914); Ris. Suppl. Ent. No. v, pp. 17, 18 (1916); Laid. Rec. Ind. Mus. Vol. xiii, pp. 322, 337 (1917); Fras. Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 744 (1923).

Copera annulata stevensi Laid. Rec. Ind. Mus. Vol. viii, pp. 341, 342 (1914); Id. ibid. Vol. xiii, p. 337 (1917).

Copera arachnoides Fras. Mem. Dept. Agric. India (Ent.) Vol. vii, No. 7, pp. 56, 57, Pl. vii, fig. 4 (1922).

Male.—Abdomen 35 to 37 mm. Hindwing 22 to 23 mm.

Head.—Labium white; labrum, genae, bases of mandibles and clypeus pale blue, the former with a tiny median black point at base, the latter with a variable transverse black mark confined to the middle of postclypeus or extending by a short median stalk to its base in others; frons and vertex in front and laterally pale blue with a broad bronzed black triangular area which begins near front margin of frons and extends to back of occiput, touching the eyes at a point only in line with the posterior ocelli, from which point it recedes again to leave a clear pale blue area against the eyes; this dark area marked with a small oval or triangular white spot between the posterior ocelli and bases of antennae, and on back of occiput by two large triangular white spots near the middle line, whilst in some specimens there is a second smaller triangular spot lying to the outer side of these; occiput beneath eyes bluish; eyes black above, olivaceous at sides and below.

Prothorax bronzed black with a lateral pale blue stripe extending its whole length.

Thorax bronzed blackish green on dorsum marked on each side with a narrow pale blue antehumeral stripe lying in juxtaposition to the humeral suture; a small upper post-humeral white spot (in Burmese specimens) or a white sickle-shaped mark (in Bengal or Assamese forms); laterally and beneath palest blue, the postero-lateral suture broadly mapped out in black.

Legs pure white, the distal ends of all femora and extreme proximal ends of tibiae black; hind femora extending to end of second segment of abdomen; tibiae very broadly dilated; tarsi black.

Wings hyaline; pterostigma reddish brown framed in white and then thick black nervures, poorly braced, covering 1 cell, more or less diamond-shaped, less so in forms from Assam; 13 to 16 postnodal nervures in forewings, 12 to 14 in the hind, the greater number in Assam forms; petiolation beginning just distad the level of proximal antenodal nervure.

Abdomen bronzed black on dorsum except segments 9 and 10 which are pale blue (Assam forms have the basal third or more of segment 9 black, whilst some Burmese forms have the whole of segment 9 and a small diamond-shaped apical dorsal spot on segment 8); segments 1 and 2 with the sides broadly blue but narrowing apicad on the latter, whilst all segments from 3 to 6 have the lower part of sides bluish; segment 2 with its base narrowly blue, segments 3 to 6 with narrow pale blue annules confluent laterally with the blue on sides.

Anal appendages pale blue or white, the apical half of inferiors black. Superiors conical, triangular, acute at apex, as long as segment 10; inferiors broad at base, tapering to an acute apex, curved strongly downwards and very slightly inwards.

Female.—Abdomen 33 to 37 mm. Hindwing 22 to 34 mm.

Differing in some respects from the male, as follows:—Head with an extension of the pale blue into the apex of the black triangle, this very variable (Assam forms are exactly similar to the males save for a pair of obscure spots, one on each side of the anterior ocellus), the frons broadly blue and more or less confluent with a series of spots on the ocellar space.—a small triangular spot on each side of anterior ocellus, another between the posterior ocellus and base of antennae as in the male, a median small triangular spot between the posterior ocelli and a spot on the outer side of each postocular spot often confluent with the latter. In some specimens, the whole of the ocellar space blue except for a narrow black bordering to the inner sides of the posterior ocelli.

Legs of great length, reddish or of the same colour as the males but with none of the tibiae dilated.

Prothorax and thorax exactly similar to the male; posterior lobe of former simple, projecting back at the middle and with a slightly crenate border.

Abdomen similar to the male except for segments 9 and 10, the former with two large subdorsal bronzed greeny black spots broadly confluent at base and along basal half of middorsum, its apical border and the whole of segment 10 pale blue.

Anal appendages very short, pale blue, conical; vulvar scales pale, not extending to end of abdomen.

Distribution.—Assam, Bengal, Malaysia, Indo-China and China. Selys also gives Japan on the authority of a specimen labelled Yokohama, in the Zurich Museum. The species, named from a female by Selys, from Malacca, as *Copera ciliata* is probably not more than a variety of this species and Selys expresses such an opinion in the *Revision des Syn. Agrionines*. This species is quite easily distinguished from all others except *Copera superplatypes* by its pronounced black colour with pale blue markings, by its broadly dilated white tibiae, and from all other species by the shape of its inferior anal appendages. The shape of the posterior lobe of prothorax and the very long hind-legs will determine the female from other females of the genus. The type in the Selysian collection, paratypes in most national collections and in the British and Indian Museums.

Contrary to the habits of *C. marginipes* and *C. vittata*, both of which breed in running water, this species breeds in weedy ponds and small lakes. The author found it quite common in the Botanical Gardens, Calcutta, resting on sedges at the borders of most tanks there. Many tenerals were flushed out from beneath bushes in the neighbourhood of the tanks.

Copera superplatypes Fraser.

Copera superplatypes Fras. Rec. Ind. Mus. Vol. xxix, pp. 88, 89, figs. 6b and 7b (1927).

Male.—Abdomen 26 mm. Hindwing 15 mm.

Head.—Labium white; labrum, anteclypeus and genae palest blue, rest of head black save for a moderately broad pale blue stripe traversing the vertex from eye to eye at level of ocellar space.

Prothorax black with a pale bluish white stripe and a spot of the same colour on each side.

Thorax bronzed black as far lateral as the anterior suture marked with pale blue antehumeral stripes bordering the humeral suture anteriorly; laterally pale blue, the postero-lateral suture mapped out in black, a black spot on the mesepimeron confluent with the black in the humeral region, and another large black spot on the centre of metepimeron; beneath blue bordered with black.

Wings hyaline; pterostigma black, covering 1 cell, diamond-shaped, slightly longer than broad, poorly braced or not at all; 12 to 13 postnodal nervures in forewings, 11 in the hind; petiolation beginning well proximal of *Ac* which lies about midway between the level of the two antenodal nervures.

Legs very short, hind femora extending only to end of thorax, pure creamy white with black spines but the distal halves of all femora black; the two hind pairs of tibiae enormously dilated, about two and a half times the width of the hind femora.

Abdomen black, the sides of segment 1 bluish white; segment 2 with a pair of oval blue dorsal subbasal spots (similar to those found in a similar situation in several species of genus *Agriocnemis*), the sides of same segment bluish, broadly so at apical end; segments 3 to 5 with the lower parts of sides bluish and confluent with narrow pale blue basal annules narrowly interrupted on the middorsum; segments 6 to 8 similar but the basal annules more widely interrupted and the lateral blue extending sub-apicad for a short distance up the sides; segment 9 unmarked; segment 10 with the dorsum palest blue.

Anal appendages creamy white, the inferiors blackish at base. Superiors slightly shorter than segment 10, conical, depressed, acute at apices; inferiors one-third longer than superiors, very broad at base, abruptly tapered and ending in a sharp point.

Female unknown. Type in the author's collection, the only known specimen.

Distribution.—A single male from Hasimara, Duars, Bengal. This species which belongs to the group *annulata*, is easily distinguished by the following characters.—the black vertex traversed by a blue stripe instead of the broad black triangle spotted with white seen in *C. annulata*, the shape of the anal appendages of which both pairs are directed back and are very similar in shape, the enormous dilatation of the tibiae which are out of all proportion to the small size of the insect, and lastly the very characteristic marking on the dorsum of segment 2.

EXPLANATION OF PLATE I.

1. Dorsal view of anal appendages of *Indocnemis kempi* Laid.
2. Dorsal view of anal appendages of *Copera assamensis* Laid.
3. Left lateral view of same.
4. Right lateral view of anal appendages of *Indocnemis kempi* Laid.
5. Right lateral view of anal appendages of *Copera marginipes* (Ramb).
6. Dorsal view of same.
7. Left lateral view of anal appendages of *Copera annulata* (Selys).
8. Dorsal view of same.
9. Left lateral view of anal appendages of *Copera vittata* (Selys).
10. Dorsal view of same.
11. Dorsal view of anal appendages of *Calicnemis mortoni* Laid.
12. Left lateral view of same.
13. Right lateral view of anal appendages of *Platycnemis latipes dealbata* Selys.
14. Dorsal view of same.
15. Right lateral view of anal appendages of *Copera superplatypes* Fras.
16. Dorsal view of same.

(*To be continued*).

OBSERVATIONS ON SOME OF THE INDIAN LANGURS.

BY

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(*With 2 plates.*)

Introduction.

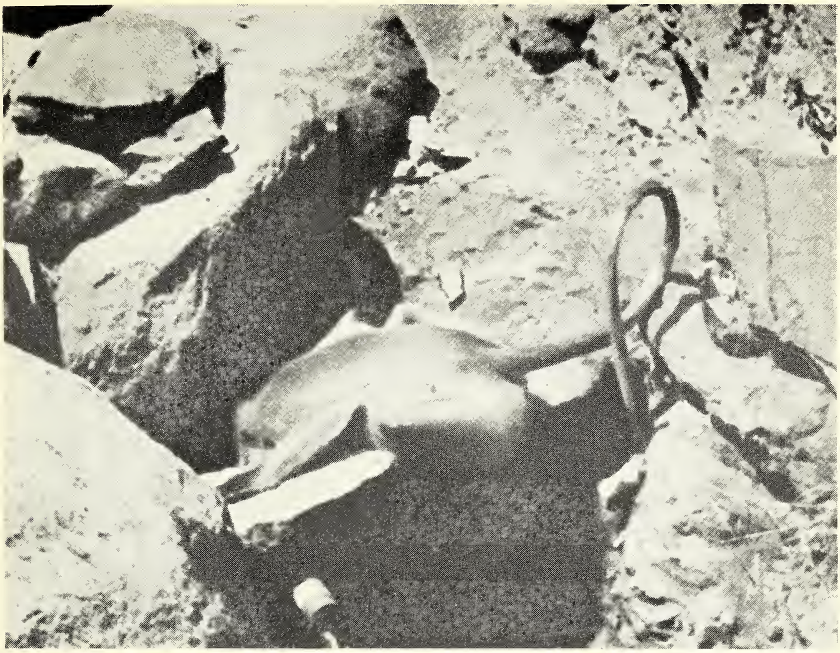
This paper is based on notes and observations, made at different intervals in various parts of India, on four species of the genus *Pithecus*. As far as possible my notes are restricted to the habits of these animals in the truly wild state. This remark particularly refers to the Common or Hanuman Langur (*P. entellus*), which in many parts of its wide range, lives under more or less semi-domesticated surroundings, as a commensal with man. As it is one of the commonest species, this langur has naturally come more under my observations than any of the others. I have had opportunities of studying it in Kanara, the Western Ghats, Gujarat and Rajputana. The Himalayan Langur (*P. schistaceus*), I was able to observe only for a brief period while on an expedition in the Terai. In the Naga Hills, Assam, I was able to collect some information on the habits of the Capped Langur (*P. pileatus*). My notes on the Nilgiri Langur (*P. johnii*) are based on specimens collected and observed on the Palni Hills, Southern India, during the time I was on the Society's Mammal Survey. My notes on this species have been augmented by some notes very kindly sent me by Fr. Leigh of Trichinopoly.

In a recent work entitled *The Social Life of Monkeys and Apes*, Zuckerman, the author, has very ably dealt with the subject of the social behaviour of these interesting primates. The author has taken very considerable pains collecting all available literature dealing with their habits. It will be clearly seen from this work how little is known of some of the commonest monkeys. To many people, the commonest animals are much too 'commonplace' to be worthy of observation. This frequently adopted attitude towards common things accounts for the absence of information. Be this as it may, the few notes I venture to record here, collected whenever opportunity offered, are but fragments put in towards completing the mosaic. I only regret that I had not more time and opportunity for furthering my observations.

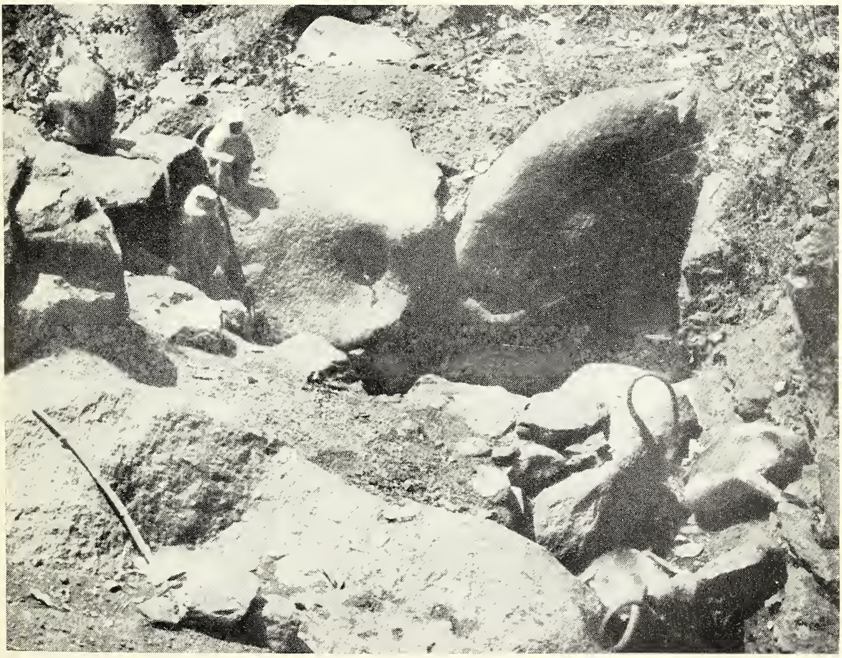
Pithecus entellus Dufresne.

The Common or Hanuman Langur.

Adults: A detailed description of this familiar langur is unnecessary. The adults vary considerably in colour in different localities, and at different seasons. Further in the same troup, there is frequently every possible gradation, dependent much on age.



Common Langur (*Pithecus entellus*) at drinking pool.



Common Langur (*P. entellus*) at drinking pool. The langur in right bottom corner is eating earth.

Photos by Author.

Young: The new-born young have deep brown fur through which the pinkish skin shows up. Face, hands and feet are brownish-black, suffused with the red glow of new birth; soon becoming quite black like those of the parents. As growth proceeds, the fur gradually changes by canescence from brown to a much paler colour than that of the adults. Judging from comparison, the change usually takes place in about two months after birth. The yearlings are easily recognised by their much paler colour than the adults in the troup. As the yearlings approach maturity, the fur begins to darken, particularly, on the back, until the final adult colouring is reached. From comparison I am inclined to the view that these langurs reach maturity when they are about six to seven years of age.

Social habits: Common as this animal is throughout the greater part of India, little definite information is recorded about its social habits and breeding season. The only point that is definitely established is that it goes about in smaller or larger troups, but the proportion of the sexes in these troups has given rise to many conflicting statements. For example, Blanford, in the *Fauna, British India* (Mammalia), p. 28 (1888), writes, 'The Hanuman is usually found in smaller or larger communities, composed of individuals of both sexes and of all ages, the youngest clinging to their mothers and being carried by them, especially when alarmed. An old male is occasionally found solitary, as with so many other mammals. The story that males and females live in separate troups, though apparently believed by Blyth and quoted by Jerdon, I agree with Hutton, in regarding as fictitious, though, as the latter observer justly remarks, females with very young offspring may keep together and temporarily apart from the remainder of the troup to which they belong.'

After much observation of this species, I am forced to the conclusion that the observations of Blanford, Blyth and Hutton need some explanation. Much depends on the time of the year these observers made their respective observations as the habits of the animals at any one particular season of the year are not applicable the year round. A generalised statement will not suffice to describe the habits of langurs throughout the year. In different places the habits may vary slightly according to the climate.

In my opinion the Hanuman Langur has a more or less fairly well-defined breeding season. It appears to me that, it is on this account, we find these conflicting statements, as the behaviour of the troups depend on this factor. The breeding season of this langur is from November to March, though some young are born in April. Most young appear to be born after January (in the Abu Hills and the Gujarat). In the Western Ghats I have noticed, that they breed about the same time.

During the non-breeding season the sexes are indiscriminately mixed in single troups, but as the Hanuman is a true polygamist, the trouble starts at the approach of the breeding season. A single male tries to take charge of as many females, in fact, all the females of the troup and establishes himself as their overlord by driving out all the potent males, big or small. The youngest males soon give way to their elders, but it is the elders which frequently enter into combat and the victor takes possession of the females. Once a male has become the overlord, he makes every effort not only to keep off all other males from his troups, but also establishes certain territorial rights. Other troups are not permitted in the area. The females take no part in the breaking up of the troup and all surrender to the victor. The troup is now composed of one overlord, females and impotent males (yearlings).

The males that were driven out of the original troup band together and go about in company till the end of the breeding season, when they again join the original troup, or from other troups. How new troups are really formed I am totally unable to say. The batchelors are as a rule very noisy and there is much fighting among them in spite of the fact that they live in one association and have not the excuse of the disturbing female element. Certain of these males appear to be held in respect by other members of the band, and it is quite possible that the male troups form the training ground for the next male which is to become overlord of the female troup. It is in the male troup that the future overlord probably establishes his superiority over the other males which hold him in respect; however, this point needs verification. Whether an overlord has only one term is open to question.

The overlord of a female troup during the breeding season is its sole protector and on no account will tolerate a potent male within his troup. He is usually closely followed by the females and the yearlings or he will bring up the rear when the troup is on the move; but he always occupies a position from which he can keep an eye on his family. In these seasonal troups, the young, including impotent males, remain with their mother and follow her till they are about three to four years old.

Early in the morning the troup goes out to feed, the leader keeping a vigilant eye on all stragglers though he does not appear to trouble much about the yearlings, but in a case of danger comes to their rescue. To illustrate this point I shall narrate a little incident which occurred while out collecting. I shot a female which was carrying her baby (probably a couple of months old). The body of the mother fell to the ground but the young remained on the tree. The report of the gun dispersed the others. The baby was most active but my attendant and I managed to isolate it on a tree, as the span to the next tree was too great. I sent my man up the tree to try and catch it. When it saw him it began to squeal. The cries of the little one soon brought the others around once more. I fired a couple of rounds to disperse them. Eventually, the leader of the troup came forward and, in spite of every attempt to drive him away, he jumped across to the tree, but before he could get to the young one I brought him down. We finally caught the baby. This shows the strong social attachment and protective instinct of the overlord of a troup. To return to the movements of the troup. The morning is spent in feeding and sitting about. Towards mid-day, they usually return to the resting place, generally near water. As soon as they have finished feeding the animals go down to drink, after which they sit about on the rocks and branches and rest for the afternoon.

When resting in the afternoon, the adults engage in picking one another's fur, sleeping and dozing, while the youngsters gambol about among the rocks and branches. The yearlings, like children, spend much time in play. During this period of rest, I have repeatedly observed females presenting their hindquarters to the overlord. Her action certainly appears to stimulate the sexual passions of the male. If he be inclined, he will walk up to the presenting female and coitus will take place. This behaviour may also be observed even when the troup is out feeding. When presenting, the female watches the movements of the overlord; in this attitude she will remain for a few moments but if her invitation is unheeded, she either sits down where she is or goes away, to return sometime later and repeat the action. I once observed a pair in coitus. To my surprise, during the act other females attacked the favoured one, squealing the while and slapping her.

During the period when an overlord is in sole possession of a breeding troup, copulation is frequent. Coitus may be repeated with the same female, each time she presents, or as I have seen with what appeared to be a pregnant female. I am of opinion that effective copulation only takes place in the breeding troup and that all the females are fertilized by the end of the particular season, by the overlord in possession, before the other males are allowed to join the original troup. In other words, the ruling overlord of one season is the father of the young born in the next season. The time when the sexes are indiscriminately mixed would therefore correspond to the non-breeding season and should copulation take place at this period it would in all probability be with females that are already pregnant. Considering the fact that coitus is most frequent in the breeding season and that the birth-rate is also highest during the same period, it appears reasonable to infer that the period of gestation in the Hanuman Langur is about nine months.

The overlord generally sits aloof from his harem. It is the females that approach him when they are sexually inclined. I have never noticed the overlord going in quest of the females. Frequently I have seen an overlord chastise a female by nipping and slapping her for some reason which I could not understand.

After a couple of hours' rest the troup moves off again to feed. Usually one or two individuals lead, they are soon followed by a few more and so on till the whole party is moving in the same direction. Towards evening, the party moves 'homewards' in the same fashion, to the roosting place. Langurs always return to the same spot for the night. The roost is easily recognized by the amount of excreta and urine on the ground. The rocks below, begin to glisten, look wet, and in the course of time shine. In spite of their wet appearance they are dry but sticky to the touch.

It is in the evening the overlord appears to herd his family, and he is generally the last to retire. There is usually much quarrelling among the members of the troup for place before they finally settle down. I have repeatedly watched these animals returning to the roost for the night, and have visited the place at different intervals during the hours of darkness. It is surprising to find that when they sleep, they do so in a sitting position at the extremities of the branches and not as one might expect on the thicker boughs. This is probably a protection against prowling carnivora which are able to climb.

Fur-picking is usually commenced by an animal seated next to another, but lying down in front or sitting close by, is usually an invitation. This is an understood signal, and operations commence almost immediately. When one has been done it will repay the compliment. Young and old engage in fur-picking but it appears to me that it is much more frequent with the adults. A mother may frequently be seen picking her offspring and she will often chastise her child for not keeping quiet during the process. While the adults are thus engaged, the active little yearlings frolick about among the branches, playing hide-and-seek or rolling over one another.

The new-born young is freely handled by its older brothers and sisters, but the mother keeps a vigilant eye on the proceedings. Should danger threaten, she is immediately by its side, picks it up and carries it off to safety. The movements of the new-born baby are frequently controlled by the mother holding on to its tail. At the hands of yearlings the new-born do not always receive gentle treatment, and they usually protest; the squeals of the baby attract the mother and she delivers it from the hands of its tormentors. The young are frequently punished by the mothers when they do not obey. The mutual understanding of the adults is so great that any member of the troup may take up a new-born, except when the troup is on the move.

I have often observed yearlings feeding at the mother's breast though she may already have a new-born to suckle. Pregnant females also allow their last baby to suckle. If disinclined, she turns her back on the baby but should it persist she gives it a nip and sends it off. Adults often slap or nip an impetuous child. This is a frequent mode of defence and I have repeatedly seen a dog slapped by one of these monkeys. When a yearling cannot jump a wide span it squeals; immediately one of the adults near-by comes to its aid, picks it up and jumps across with the yearling sticking to its belly. On reaching the other side, it is put down again.

From the above it will be seen that my observations are not in total agreement with those of Hutton who states, that, 'The only approach to a separation at any season consists in the males of a troup keeping together and the females doing the same if there are very young ones among them; but the two divisions form but one troup; and I am not even yet quite sure that such a trifling division really takes place.'[1] Hutton clearly expresses a doubt on the subject. As I have already indicated above, females do not separate from the breeding troup at the time when they have new-born young, but that the males are temporarily driven out of the original troup by the overlord of the season.

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[1] *ex The Social Life of Monkeys and Apes* by Zuckerman, p. 183.

It is often suggested, and even stated, that troups of monkeys post 'sentinels'. My observations do not lend support to these statements. Each animal is its own 'sentinel', and at the same time a 'sentinel' for the entire troup. The one which first espies something suspicious, immediately gives the alarm which brings the whole troup to attention. From the position or movements of the alarmist each individual is able to ascertain the direction of the enemy and all act accordingly. Should it immediately take to flight the others do likewise without further investigation. As soon as they have put distance between the enemy and themselves, monkeys will frequently try to investigate the nature of the alarm.

While in the Abu Hills, I once heard the alarm call of a langur, and I carefully went to investigate the cause. It was in a stony watercourse where there was a small spring. On the trees of the opposite bank a langur was seated swearing. It was just a little past 5 o'clock in the evening and the sun was still well up in the sky. When I reached the spring, I was surprised to find the wet pug-marks of a panther on the hot rocks. I was just too late to see it as it disappeared down the rocky bed. The langur's gaze was fixed in the direction the panther had taken and he kept up the harsh barking. It did not pay much attention to me, but kept its eye fixed on the retreating panther—just this one male kept up the barking—the females took no part in the proceedings. A couple of mornings later I went down the same stream and to my surprise found some old remains of a langur's skeleton; just the upper portion of the skull and facial region and also one of the scapulars lying under a rock. The remains surely indicated what was left of an old feast.

Food: From all accounts the Hanuman is a pure vegetarian, and my own observations go to confirm this. On some of the railway stations in Gujarat I have seen them feed on all possible kinds of cooked food. They appear to be very fond of the Indian hand-bread or *chaupatti*. It seems extraordinary that though these animals are very common on some of the platforms they never make a raid on the wares of the Indian food- and fruit-vendors.

In the Abu Hills I was able to record the following species of food-plants during the months of March and April 1932. At the time most of the trees were bursting forth into bloom and leaf.

Bombax malabaricum DC. Flowers, seeds and cotton in tender pods.

Terminalia bellerica Roxb. Tender shoots and inflorescences.

Odina Woodier Roxb. Inflorescences.

Balanitis Roxburghii Planch. Young leaves, buds and flowers.

Wrightia tinctoria R. Br. Young shoots, leaves and inflorescences.

Anogeissus latifolia Wall. Young shoots, leaves and inflorescences.

Dalbergia Sissoo Roxb. Young shoots.

Saccopetalum tomentosum H.f. & T. Young leaves and flowers.

Acacia arabica Wild. Leaves.

Acacia (3 other species). Leaves.

Ficus glomerata Roxb. Young shoots. (No ripe fruit at the time).

Ficus bengalensis L. Tender shoots, stipules and fruit.
Ficus (2 other species). Fruit, tender shoots and leaves.
Azadirachta indica A. Juss. Young leaves and flowers.

These langurs drink water regularly about mid-day, and sometimes also in the evening before retiring. In the Abu Hills I have also observed these animals licking and eating earth near the spring at which they drank.

PITHECUS SCHISTACEUS Hodgson.

The Himalayan Langur.

Adults: Like the other members of this genus, the males are much larger than the females. Here also there is to be found much individual variation.

Young: As in the Common Langur the new-born are deep brown, with the face, hands and feet dark. As they grow older the fur gets lighter. The yearlings in a troup are easily recognized by the much lighter coat than their elders.

Breeding season: In my opinion, this species also has a definite breeding season which is, like the Common Langur, during the winter months. Breeding troups are dominated over by a single overlord. Most females that I came across, during the time I was in the Terai, (February), had new-born young or were pregnant.

Social habits: The social habits of these animals appear to be much like those of the Common Langur. They wander about in fairly large troups. As stated above, breeding troups are composed of females, yearlings and a single overlord. Presumably, there is a mingling of the sexes when the breeding season is over. They were quite common along the Soheli river.

Food: Along the Soheli river I found this species feeding on the young shoots of the *Jambool* (*Eugenia Jambulana* Lam.), the inflorescence of *Trewia nudiflora* L. and on the leaves and fruits of the *ailah* (*Acacia concinna* DC.).

PITHECUS JOHNII Fischer.

The Nilgiri Langur.

Social habits: To all appearances these animals move about in much smaller parties than the Common Langur, but owing to their shyness on the Palnis, due to constant persecution for their flesh and skins, I was unable to obtain any definite data with regard to the numbers composing a troup. Whether the troups break up during the breeding season needs further investigation, but such a course suggests itself if we take into consideration the habits of the allied species. In the Palnis they inhabit the dense *sholas* and may frequently be seen crossing the open stretches of grass between the *sholas*.

I have frequently observed young females 'solitary' or two together. Fr. Leigh in a letter to me remarks that the Kodaikanal solitary males are evidently fierce fighters and that practically all had scars or gashes, usually one of the ears was split and wounds on the tail were common.

At Kodaikanal this langur is fond of sunning itself in the morning on the topmost branches of the tallest Eucalyptus trees near the *sholas*. The afternoon is spent in sleeping and that soundly.

When cornered, they drop to the ground and run along at a good pace. A favourite way of hunting these animals is with the aid of a dog. As soon as the monkey spots the dog it commences to bark at it and so they both argue while the hunter creeps up to the spot.

In Palni Hills this species does not descend below 3,000 ft. whereas in the Tinnevelly Hills they are found at the foot of the hills (Leigh).

Breeding season: Very little appears to be definitely known about the breeding season of this species. Fr. Leigh supplied me with the following data:—'8th May 1919, shot a female, young foetus in womb within a few days of delivery, fully formed' (Kodaikanal). Two other records of young mentioned by Leigh do not prove anything as the approximate ages are not mentioned. For the Tinnevelly Hills, Leigh records:—'20th December (year?) received a very young one; 29th December (year ?) received a young one apparently just born.' This meagre evidence seems to show that the breeding is during the cold season, like those of the other species mentioned above. The late birth of the Kodaikanal specimen may possibly be exceptional but for want of proper data this must be left an open question.

Weights and measurements:—

Locality	Sex	H & B	T	E	Hf.	Weight	Collector	Remarks
Kodikanal ..	♂	23″	32″	...	...	24 lbs.	Leigh	
,, ...	♂	24″	32″	...	...	26 ,,	,,	Part of tail bitten off. Ear torn.
,, ...	♂	26″	28″	...	...	29 ,,	,,	End of tail bitten off. Two deep gashes on the tail.
,, ...	♂	25″	27″	...	...	29 ,,	,,	End of tail bitten off.
,, ...	♀	23″	32″	...	...	24 ,,	,,	
Tinnevelly Hills ...	♂	26″	36″	...	...	20 ,,	,,	

The heaviest female recorded is a specimen collected by myself at Kukal, Palni Hills, which weighed 25 lbs. This specimen is mentioned by Mr. Pocock, *J.B.N.H.S.*, xxxii, 504, but wrongly attributed to the collecting of O'Brien. The specimen mentioned from Kukal is evidently my No. 138. Neither Shortridge nor O'Brien collected at Kukal.

Attributed uses of the flesh: The flesh of this langur is highly prized by the local natives and is attributed to possess certain medicinal properties. According to the information I was able to gather, the flesh etc. of this animal is used in the following ways:—The *blood* when fresh is drunk by people and is supposed to be a medicine against all complaints. The *flesh* is hung up and dried, or smoked and when required made into soup which is taken as a cure for asthma and coughs. The *gall* is drunk and, like the blood, is supposed a cure for all diseases.

PITHECUS PILEATUS Blyth.

The Capped Langur.

Adults: *Sexual characters*: The males of this species like those described above are much larger than the females. A point which struck me most forcibly in the field at the time when I obtained specimens of this species, was the appearance of the male genital organs. The genital organ of most male monkeys is frequently a prominent feature, particularly in the case of the Macaques. The penis and scrotal sac are usually well-developed. In the other members of this genus that I have seen, the penis and scrotal sac are clearly visible, but in the present species, the scrotum is entirely absent. The skin about the hindquarters and inside the thighs, is suffused with light cobalt blue in life. The bluish tinge of the hindquarters is not so pronounced in the females as in the males. The mammae are black.

It is extraordinary that neither of the older observers nor collectors have remarked on the absence of the external scrotal sac. Mr. Pocock[1] in his paper on the Langurs does not mention this point.

In the facial expression and contours, the Capped Langur is very different from the other members of this group that I have described. The face is much more flattened.

Young: According to Mr. Pocock[1] the new-born young of this species is said to be 'a uniform golden or orange red all over'. A very young specimen which I secured and in which only the two upper and lower incisors had barely cut through the gums, was a creamy-white all over the body, with a slight ferruginous tinge along a narrow portion of the back and the tail. As the teeth in these animals appear very soon after birth, the question arises whether the young, if at first 'golden' as stated by Mr. Pocock, changes from golden to creamy-white or acquires the ferruginous tinge after passing through a creamy-white phase. As the change of colour of the fur in juvenile monkeys is rapid, I am inclined to the latter belief, namely, that the young are born creamy-white and then change to ferruginous. When my specimen was in the flesh I did not notice any ferruginous wash on the fur. The pinkish colour of the skin of a new-born shows through the fur. Though

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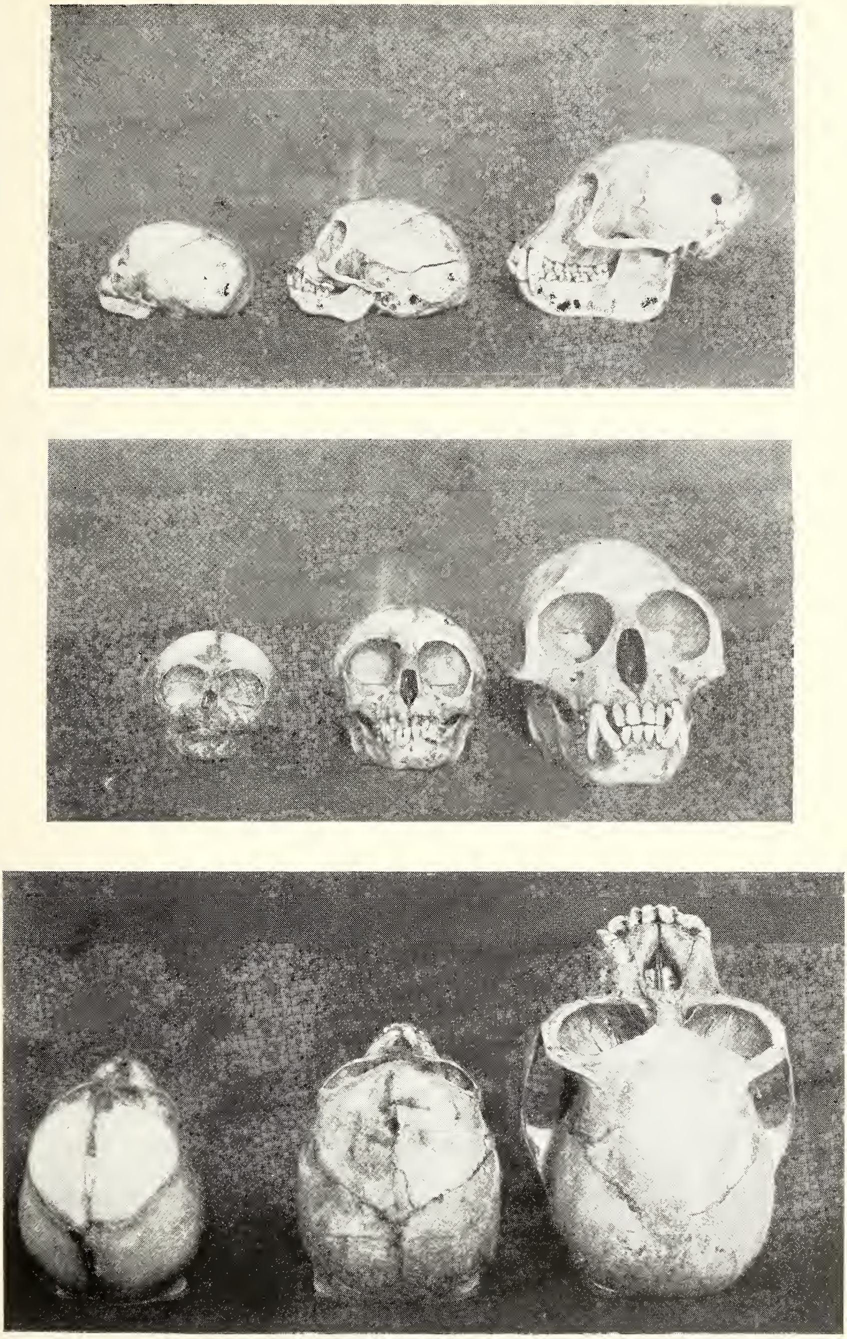
[1] *J.B.N.H.S.*, xxxii, p. 660.



Left: new-born. *Centre*: yearling. *Right*: adult.

Skulls of the Capped Langur (*Pithecus pileatus*) showing the contours of the skulls at different ages.

Photo by Author

the adults and yearlings have the face, the ears, the palms of the hands, and the soles of the feet *black*, these regions in the newly-born are pinkish flesh and *not* black. When the transition from the pinkish colour to black takes place I am unable to say with any degree of certainty; however, I suspect that the change takes place in a few months after birth, as the yearlings of the previous year exhibit the same colouring as the adults. Mr. Pocock in his paper on the Langurs does not mention this point.

As growth proceeds, the fur gets more dense and more silky, at length becoming greyish on the dorsal surface. The parts which in the adults are ferruginous or golden are light fulvous. The tints intensify with age until the adult colouring is reached. In some cases, the tail may be long-haired towards its extremity or covered with hairs of uniform length throughout. However, the length of hair and colour is a very variable character within reasonable limits, and, in my opinion, is of little specific importance.

The yearlings of the previous year have a full complement of 20 teeth while the adults have 32.

Social habits: Unlike the Common Langur, this monkey does not wander about in large troups. Most of the troups are composed of from 8-10 individuals, an overlord, three or four females and young of different ages and of both sexes. The species is polygamous. These observations apply to the winter months which is the breeding season of this species, when I was in their habitat. Whether there is an indiscriminate mixing of the sexes and whether larger troups are formed during the non-breeding season is open to question. The Nagas say that they never band together in large numbers. Beside the breeding troups, I have noticed other troups, composed apparently of immature males (?), but even these troups were not larger than the ones already referred to. It appears as though the young animals are driven out of the original troups and that they herd together for company and safety. It is possible that these non-breeding troups are the beginning of future breeding troups; however, information is still required on the subject.

This species inhabits dense forests where there are streams, but I have never observed them come down to water. Living in forests where the dew is very heavy and the rainfall frequent, it is perhaps unnecessary for them to come down to drink. On the whole, they are very shy and on approach take to flight or conceal themselves in the foliage of the topmost branches of trees where they remain quietly till the danger has passed. Their progression is much like that of the Common Langur, but I have never seen them descend to the ground. Going through the forest, they make a tremendous noise, the branches bending and breaking under their weight, as they jump from tree to tree.

The harsh bark, already mentioned as an alarm call in the case of the other langurs, and the squealing are the only sounds I have heard these monkeys make.

Once I shot two females, both with young. One of the babies was only wounded. Its squeals attracted the attention of the large male, who up to this time was somewhere in hiding. On hearing the young one he came crashing through the branches in its direction. As I was standing near it, he came straight at me as though about to attack. His attitude was very menacing indeed—barking and grunting at me with a toss of his head and jumping about among the branches. I watched the proceedings, prepared for eventualities, in fact, at one time he came so close, that it looked as though his next leap would be upon me, but suddenly he changed his mind and went off in the opposite direction, but before he could go far I brought him down to add to my collection. Probably the intention of the animal was to try and rescue the baby and not attack, but seeing that he stood little chance turned tail.

Food: As far as I was able to ascertain this species like its cogeners is a vegetarian. Examination of the stomach contents revealed buds, leaves and fruit.

Measurements of *Pithecus pileatus* taken in the flesh. Measurements in millimetres.

No.	Sex	Locality	H.B.	T.	H.F.	Ear.	Remarks.
18	♂	Changchang Pani.	215	335	90	26	New-born.
49	♂	,, ,,	670	990	200	...	Leader of a troup.
53	♂	,, ,,	344	455	118	35	
55	♂	,, ,,	575	810	180	38	
117	♂	,, ,,	640	900	195	37	
47	♀	,, ,,	565	860	185	35	
99	♀	,, ,,	575	754	170	30	
57	♀	,, ,,	545	705	155	28	
51	♀	,, ,,	575	810	180	34	
113	♀	,, ,,	543	820	187	32	

THE CIVET CATS OF ASIA.

BY

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Part II.

(*Continued from page 449 of this volume*).

(*With 1 text-figure*).

Genus: Viverricula, Hodgs.

Viverricula, Hodgson, *Ann. Mag. Nat. Hist.*, 1, p. 152, 1838; *id. Journ. As. Soc. Bengal*, 10, p. 909, 1841 and of most subsequent writers including Blanford, *Mamm. Brit. Ind.*, p. 100, 1888; and Pocock, *Proc. Zool. Soc.* 1915, pp. 136 and 147 (feet and glands).

Viverrula, Hodgson, *Calc. Journ. Sci.*, 2, pp. 53-55, pl. 1, 1842. (by error for *Viverricula;* misprinted *Viriccula* in explanation of pl.).

Type of genus: *V. indica.*

Distribution: Peninsular India from Sind, the Punjab and the foothills of the Himalayas southwards into Ceylon and eastwards into southern China, Indo-China, Burma, Malacca and Java.

Diagnosis: Distinguished from *Viverra* and *Moschothera* by the absence of the dorsal crest and by the insertion of the ears, their anterior edges being noticeably closer together on the forehead. Feet like those of *Moschothera* in the absence of the skin lobes protecting the claws of the 3rd and 4th digits of the fore foot. (Text-Fig. 1, C.D., xxxvi, p. 425.).

Skull very distinct in the strong compression of the posterior part of the cranial portion above, the large bullæ considerably exceeding in length half the length of the upper premolar and molar teeth, the comparatively short, weak muzzle, with the infraorbital foramen set forwards above the junction line of the 2nd and 3rd premolars, and the relatively longer subocular cheek-area, the suture between the maxilla and the zygomatic arch being as long as the upper surface of the nasals. The mandible has the condyle and angular process projecting behind more prominently beyond the coronoid which is lower and less backwardly sloped. (Text-Fig. 5, p. 641).

This genus was established by Hodgson for two previously described forms then regarded as distinct species, namely, *Viverra indica* and *V. rasse.* Since one of these is the type of the genus, I select *indica* which antedates *rasse* by fourteen years.

For the following reasons I adopt *indica* as the name for the one and only species of *Viverricula* admitted by most recent authors.

For over half a century the name *malaccensis* Gmelin (*Syst. Nat.*, i, p. 92, 1788) has been used for it. Robinson and Kloss, for example, expressed the prevalent opinion in 1920 when they wrote of *malaccensis* as the genotype of *Viverricula*, stating that it was based upon the description and figure of a specimen obtained by Sonnerat in Malacca. Sonnerat (*Voy. aux Indes*, ii, p. 144, pl. 19, 1782), it is true, published a description and a figure of an animal he called 'La Civette de Malacca' and Gmelin named it *Viverra malaccensis*. But the older French authors, Cuvier, Geoffroy and Desmarest, who evidently knew something of the facts, refused to admit *malaccensis* as symbolising a distinguishable species. Sonnerat may admittedly have seen one or more of the four species of Civets found in Malacca, but his description fits none of them, perhaps the *Viverricula* least of all; and Desmarest's remark 'it is known that the drawing of it was made in Paris from a poor sketch of the Cape Genet'[1] is tolerably conclusive evidence that Sonnerat had no example from Malacca to use as a model. It is not surprising that there are discrepancies between the figure and the description. The figure resembles no known Viverrine species; and it is impossible to guess to what extent the description was influenced by the sketch, for example, of the 'Cape Genet' above referred to. Setting aside the figure as valueless, I find some features mentioned in the description which prohibit the view that it was taken from an example of *Viverricula*. Sonnerat described the colour as 'pearly grey', darker on the back, with three black bands on the neck beginning behind the head and ending at the shoulders and three others extending over the loins to the tail. It is, of course, possible that pearly grey, black-patterned examples of *Viverricula* occur in Malacca, as they do in Ceylon and India; but the few Malaccan specimens known to me are rather richly tinted, buff or ochreous on the interspaces and have the pattern diluted with ochreous speckling. I have no wish to lay undue stress upon that difference; but with regard to the stripes it may, from my experience, be positively asserted that no representative of *Viverricula* has three well-marked black stripes on the neck, one, of course, being median, and only three on the loins, there being at least five when the pattern is well defined. In the features mentioned and others quoted below the description of *Viverra malaccensis* fails to apply to Malayan examples of *Viverricula*. It might, however, have been taken from a specimen of *Viverra zibetha* resembling the one in the British Museum collected by Robinson and Kloss at Kuala Lumpur and identified as *pruinosa* (see p. 435). The ground colour of this specimen is 'pearly grey', there is decided blackening of the middle line of the neck making, with the two lateral bands, three stripes on the nape, and the confluence of the upper row of spots on the hind back make, with the median black band, three stripes over the loins to the root of the tail. Even Sonnerat's description of the tail of *malaccensis* as having 10 rings can be approximately squared with the tail of *Viverra zibetha* if the black and white rings are counted! On the available evidence then it seems that a better case could be made for regarding 'la Civette de Malacca' as represented by *Viverra zibetha* than by the Malaccan *Viverricula;* and nothing further need be said to justify the removal of *malaccensis* from *Viverricula* and the adoption of the decision of the early revisers of this group to discard the name as systematically valueless.

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[1] *Mammalogie*, pt. i, p. 207, 1820. Geoffroy even stated that the specimen was from the Cape and was seen by Sonnerat for the first time in Paris (*Mag. de Zool.*, 1836, p. 10).

Another old name, included by some authors, e.g. Trouessart and Lydekker, under *Viverricula* as a synonym of *malaccensis*, must also be eliminated from that genus. This is *Viverra leveriana* Shaw (*Mus. Lever.*, ii, p. 19, pl. 1796). The description, copied from Pennant, and the figure issued by Shaw, disagree in important points. The figure reminds me of *Genetta rubiginosa* more than any other Viverrine. Most emphatically neither the figure nor the description agrees with any form of *Viverricula.*

The next name in order of date is *indica* which unquestionably applies to a *Viverricula.* It was given by Geoffroy in his Catalogue of the Paris Museum to a specimen brought by Sonnerat from 'India', which was not, as Geoffroy explained, the specimen Sonnerat referred to as 'la Civette de Malacca'. This Catalogue was printed, and paged proofs were given to some of Geoffroy's friends, but it was never published in the strict sense of the word,[1] being withdrawn by Geoffroy himself. This explains why Desmarest quoted Geoffroy as the author of the name *indica*, a course I have adopted, but the name must date from Desmarest's publication of it in 1817. Geoffroy described this specimen as dirty white (*blanc sale*) in colour and marked with brown spots and lines, one line on each side of the neck, two collars on the throat which, like the rest of the under side, is greyish white; tail long, banded brown and white. According to Desmarest the colour was yellowish white (*blanc jaunatre*), with eight complete bands on the back. Both authors agreed as to the generally pale whitish hue of the type; but neither said anything about the length or texture of the coat; and since the coat bleaches white, before being shed, in many races of *Viverricula*, the description is not very helpful in the application of the name to a particular race; and the difficulty is increased by the vagueness in those days of the meaning of 'India'. At all events it is quite clear from Geoffroy's published account of *Viverra indica* (*Mag. de Zool.*, p. 10, 1836) that he did not accept Sonnerat's 'India' as signifying Hindostan in particular. In this, his second, description of *indica*, he deliberately disregarded the type as being discoloured and in poor condition and applied the name comprehensively to all the known representatives of this Civet, including the Javan *rasse* of Horsfield and the Chinese *pallida* of Gray. Of specimens known to him he referred in particular to examples from Cochin China and the Malabar coast of India. These he declared to be alike in having the ground-colour tawny brown, with numerous chocolate brown spots, five stripes on the back and seven bands on the tail. He does not seem to have been aware that four years earlier Sykes and Horsfield (*Proc. Zool. Soc.*, 1832,

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[1] I understand from Dr. C. Davies Sherborn that only two copies of this rare work are known. One, which was formerly his property, he transferred to the Library of the Natural History Museum. It is to him that I am indebted for my information regarding it.

p. 22) had also applied the name *indica* to examples of this Civet, found in the woods of the Western Ghats, which were described as 'light grey inclining to yellow'. Since, moreover, Robinson and Kloss, apparently quite independently, identified examples from Dharwar, in the Western Ghats, as *indica*, I abide by that decision and regard the name as applicable in a subspecific sense to the form of *Viverricula* inhabiting that and other parts of southern India. But since all the known kinds of *Viverricula* belong, in my opinion, to one species only, that species must take the name *indica*, the oldest available, now that *malaccensis* can no longer be considered. And that was the verdict of Geoffroy nearly a century ago.

VIVERRICULA INDICA MAYORI, subsp. nov.

Locality of type: Maha Oya, E.P., Ceylon.
Distribution: Ceylon.

Diagnosis: Distinguished from the South Indian race, described below as *indica*, by its slightly smaller size on the average, shorter tail and by the absence of noticeable change in colouration and in the length and thickness of the coat throughout the year. The general colour is on the whole tolerably uniform, varying from grey to buffish grey on the interspaces; the pattern is normal, always distinct and black or blackish brown in tint, but varies a good deal in boldness not only in the width of the dorsal stripes but in the extent to which they are broken up and more or less coalescent. No two examples are exactly alike and there are several instances of specimens from different localities being more like each other than either is like a second example from its own locality.

The British Museum has a good series of skins collected in all provinces of the island, the most valuable being those procured for the Mammal Survey by Major A. W. Mayor who recorded the weights as well as the flesh-measurements. The dates of capture ranged from May 3rd. to December 3rd., passing from summer to winter. Curiously enough all the specimens with full particulars are marked as males. The dimensions are given in the following table. The example from Matugama which was not weighed was presented by Mr. W. W. A. Phillips.

Locality and Sex	Head and Body	Tail.	Weight.
Maha Oya, E.P., ad. ♂	23 ins.	14⅘ ins.	6½ lbs.
Maha Oya, E.P. (type) ♂	21⅕ ,,	13⅘ ,,	5 ,,
Kumbukkam, Uva ♂	22⅕ ,,	13⅕ ,,	5½ ,,
Matugama ♂	22 ,,	13⅘ ,,	...
Tammanewa, N.C.P. ♂	21⅘ ,,	12⅘ ,,	4½ ,,
Welligatta, S.P. ♂	21 ,,	13⅘ ,,	4¾ ,,

Bonhote (*Ann. Mag. Nat. Hist.* (7), i, p. 120, 1898) with very little material to judge from, assigned the Ceylonese examples of this Civet to the same race as the Javanese described by Horsfield as *rasse* in 1824 (cf. *infra*, p. 655). In size, comparative shortness of tail and uniformity of coat and colouration throughout the year, the two are much alike; but the Cingalese race is on the average paler and less olive grey in hue, and has the end of the tail whiter.

Skull measurements of some Ceylonese specimens:—

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
Kumbukkam, Uva ad. ♂	4	1·9	·6	·7	19	8	9×5
Maha Oya, E.P. ad. ♂	3·8	1·8	·4½	·7	19	7	8×5
Central Province, ad. ♂	3·7	1·7	·4	·6+	18	7	8×5
Kotiyagalla, yg. ad. ♂	3·8	1·8	·5½	·6½	19	8	8×5
Matugama, ad. ♂	3·8	1·7+	·4	·6½	19	6	8×5
Maha Oya, E.P. (type) ♂	3·8	1·8	·5	·6	19	7	8×5
Tammanewa, N.C.P., sub-ad. ♀	3·8	1·7	·4½	·6½	18	7	7×5
Kandy, old ? ♀	3·6	1·7	·5+	·6	17	7	8×5

These measurements show that the skull of this race is on the average a little shorter than in the typical race, *V. indica indica* from South India, next described, and that the upper carnassial tooth is a trifle smaller. The first specimen on the list is exceptionally large.

VIVERRICULA INDICA INDICA, Geoffroy.

Civetta indica, Geoffroy, *Cat. Mamm.*, p. 113, 1803.

Viverra indica, Desmarest, *Nouv. Dict. d'Hist. Nat.*, 7, p. 170, 1817; *id. Mamm.*, pt. 1, p. 210, 1820; Sykes and Horsfield, *Proc. Zool. Soc.* 1832, p. 22; Geoffroy, *Mag. de Zool.* 1836, p. 10 (in part; specimens from Malabar).

Viverricula malaccensis indica, Robinson and Kloss, *Rec. Ind. Mus.*, 19, p. 177, 1920.

Locality of type: 'India'; Western Ghats (Sykes and Horsfield); Dharwar (Kloss and Robinson).

Distribution: Southern India from the Western to the Eastern Ghats, and, according to Robinson and Kloss, as far north as Lake Chilka on the east coast.

The Survey procured a large number of skins which I assign to this race.

Dharwar, 2,300-2,500 ft. (*J. C. Shortridge*). ♂, November 9, has the coat coarse, shaggy and long, 37 mm.; the interspaces are decidedly grey, almost silvery, and the pattern is rather obscure, partly from the length of the coat, partly from being diluted with buff or ochreous buff; the pale stripes on the tail show very little colour. ♀ December 8, differs in having the coat smoother, but thickish and long, 38 mm., and in being dull buffy grey, not so bleached, with the pattern, although diluted, more conspicuous and the pale rings on the tail decidedly ochreous. Of three additional males, dated December 11 and January 4, one is intermediate in tint between the two described, but has the tail as in the second, the others being like the second, the coat varying from 35 to 37 mm.

Medha in Satara, to the north of Dharwar. One specimen, collected by S. H. Prater, on December 11, is like the Dharwar series, pale buffy grey, with the blackish pattern diluted with ochreous and the coat 42 mm. long.

Haleri, N. Coorg, 3,555 ft. Four skins, dated January 25, February 4, 5, and 23, are like the Dharwar series, three of them resembling the first in being greyish; but the January skin is a little brighter coloured than the brightest of that lot. The coat in this skin is 34 mm., but in the skin dated February 23, it is 40 mm.

Wottekolli, S. Coorg, 2,000 ft. January 7, resembles the buffy or brownish grey Dharwar skins, the coat being 32 mm.

Kutta, S. Coorg, 2,843 ft., February 11, resembles the pale grey Dharwar and N. Coorg skins, differing noticeably in its bleached coat from the Wottekolli skin. The coat too is longer, measuring 37 mm.

Benhope in the Nilgiri Hills, 3,000 to 4,000 ft. A pair (*J. Riley O'Brien*), dated July 10 and 12, closely resembles in colour and pattern the skin from Dharwar, December 8; but the coat is harsh and thinner and shorter, measuring from 26 to 30 mm.

Ootacamund in the Nilgiris (*P. H. Gosse*). An undated skin has the coat rather coarse, thick and long, about 35 mm. It is very like the examples from Benhope and closely matches the skin from Haleri in North Coorg, dated February 23.

Payangadi in N. Malabar (*Major W. S. Dallas*). A male, Oct. 17, is dull, dusky greyish brown, without bright colour, and the pattern is black; the coat is fresh and short. This specimen is very like the one from S. Coorg, dated Jan. 7, and also like the typical skins from Dharwar.

Trivandrum, Travancore (*H. Ferguson*). A young undated skin is like the last.

The foregoing specimens from the Western Ghats and the Nilgiri Hills, seem to represent typical *indica*. The following from the Eastern Ghats I cannot separate from them.

Kurnool (*N. A. Baptista*). Two examples, one collected at Diguvametta, May 4, the other at Malakondapenta on May 17, have the coat shaggy, harsh and long, about 37 mm., but thinner, with less underwool than the winter skins from Dharwar and the interspaces bleached white; the pattern distinct, blackish but in one specimen tinged with ochreous. Tail with 7 and 8 rings respectively. In harshness and length of the dead coat these specimens are very like the first-described example from Dharwar dated November 9 and the example from North Coorg dated February 23.

Kondagorlapenta, in the Palkonda Hills, Cuddapah, south of Kurnool (*N. A. Baptista*). A female, July 15, is apparently in new coat which is tolerably full but not long, only 25 mm. The interspaces are clean white, without any buff tint, and the pattern is bold and black. A male, July 24, and a female, August 2, on the contrary, have the coat harsh, shabby and dead, with the moult in progress; the interspaces are pale grey with a buffy wash. These examples are very like the skin from Dharwar, dated November 9, but the coat is not so thick and is shorter, only 29 mm., and the pattern is more obscure. There is a sharp contrast in colour and in the length and texture of the coat between the first of these specimens and the remaining two. The former seems to have completed the moult and grown the new coat earlier. It is an exceptionally black and white specimen for this race.

Madhavaram in the Vontimutta Range, 325 ft., Cuddapah (*N. A. Baptista*), September 14. A young male, with the coat only about 26 mm., almost exactly matches the specimens from the Nilgiri Hills referred to above.

Tirthamalai, Salem, 1,000 ft. (*N. A. Baptista*). A male, July 2, has the coat coarse and brittle, 30 to 34 mm.; the interspaces are greyish white, but not quite so silvery as in the Kurnool specimens, being intermediate between them and the coarse coated Dharwar and Haleri specimens.

Aigur in the Denkanikota Range, 3,062 ft., north of Salem, October 22. A female has the coat fresh, about 30 mm. long, and resembles in colour and pattern the better coloured Dharwar skins.

Conclusion: The general colour of this race, when the coat is soft and full, is decidedly dull, varying from brownish or olivaceous grey to lighter grey, with the pattern well defined, blackish, brownish, sometimes with ochreous speckling rendering it less conspicuous. Occasionally brighter more ochreous specimens occur like those from North Coorg, January 25, South Coorg, January 7, and the Denkanikota Range, October 22; but these only differ slightly from the better coloured examples from Dharwar. Quite exceptional in the black and white colouration of the new soft coat is the example from the Palkonda Hills, July 15.

Before the moult the coat undergoes great change, but the date of the moult does not appear to be constant. The two examples from Kurnool, killed in May, appear to have started moulting. They differ remarkably from the Dharwar skins, December and January, in having scanty underwool covered by long, coarse and brittle hairs, apparently bleached white in the interspaces. But the example from Dharwar, dated November, is surprisingly like these in the length, harshness and shabbiness of the coat. Possibly the date is incorrect. I should have taken it for an April skin. Two of the specimens from the Palkonda Hills and those from the Nilgiris, all killed in July, have the coat thin, brittle and dead, but it is shorter than in the Kurnool specimens. It is possible that the tips of the long brittle hairs break off and shorten the coat. From these specimens it seems that the coat becomes harsh, brittle and dead from May to August and is then changed. At all events the skins from the Vontimutta Range, September 14, the Denkanikota Range, October 22, and North Malabar, October 17, have fresh soft coats like the December and January skins from Dharwar.

Some flesh-measurements and weights are entered in the following table:—

Locality and Sex	Head and Body	Tail	Weight
Satara ♂	24⅕	15⅖	8 lbs.
Dharwar ♂	25⅕	16⅘	...
,, ♀	24	15⅗	...
,, ♀	23⅕	16⅗	...
Salem ♂	22⅕	15⅖	6 lbs.
Kurnool ♂	22⅗	16⅘	7 ,,
Dharwar ♀	23⅗	16⅖	...
,, ♀	22⅘	15⅖	...
Palkonda Hills ♀	22⅕	15⅕	5 lbs.

Some skull measurements of adult examples assigned to this race are as follows:—

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
Satara ♀	3·9½	1·6½	·5	·6	18	8	8×5
Dharwar ♂	4·1	1·8	·5 –	·6¾	20	8	9×6
,, ♂	3·9½	1·8	·5	·6	17	8	9×6
,, ♂	3·9	1·7	·5½	·6½	19	7	8½×5
,, ♀	3·9	1·8	·5	·6½	19	8	8½×6
,, ♀	3·8	1·7	·5	·6	16	9 –	8½×6
Wottekolli, S. Coorg ♂	3·8	1·7½	·4½	·7 –	18	7	8×5
Virajpet, S. Coorg ♂	3·9½	1·7	5½	·6½	20	6	8×5
,, ,, ♀	3·9	...	·5	·6	18	...	8+×5
Nilgiri Hills ♂	3·8	1·7	·5	·6	18	8	8½×6 –
Vontimutta Range ♂	3·9 –	1·7	·5	·6½	17	9	8×5
Palkonda Hills ♂	3·8	1·7	·5	·6	17	8	9×5½

Viverricula indica bengalensis, Gray.

Viverra bengalensis, Gray and Hardwicke, *Ill. Ind. Zool.*, i, pl. 4, 1832.

Viverricula malaccensis bengalensis, Robinson and Kloss, *Rec. Ind. Mus.*, 19, p. 177, 1920.

Locality of type: 'Most part of Bengal' (Gray); arbitrarily fixed by Robinson and Kloss as Calcutta.

Distribution: Apparently central portion of India, south of the Ganges, from Calcutta to Gujerat and possibly Sind.

Gray published nothing but an indifferent, coloured figure of this Civet, showing the head and back dark greyish brown, the flanks and thighs apparently white with a buffish tinge, the tail with ten dark rings and its pale rings buff-tinted.

The name *bengalensis* was ignored, except as a synonym, until Robinson and Kloss revived it in 1920 for some specimens labelled Calcutta. These they described as greyish buff, quite without any rufous tinge and with the pattern black and sharply defined. They distinguished the race from *indica*, occurring farther south, by its paler colour, rather larger skull with the *bullæ* longer, higher and less compressed. Although these alleged cranial differences, referred to below, do not hold good for the specimens I have seen, I provisionally adopt the racial name *bengalensis* for a few specimens obtained at scattered localities in Central India by the 'Mammal Survey'.

Yagodib, Hazaribagh, 600 ft. An adult pair collected on April 17 and 18 by Crump at this locality some 200 miles N.-W. of Calcutta should be the same as Robinson and Kloss's examples from that town. The ♀ is pale yellowish buff with the dorsal stripes diluted with rusty ochre and not sharply defined. The coat shows signs of thinning but is still soft and about 30 mm. long. The ♂ is greyish buff on the head and forequarters but over the loins the interspaces are bleached whitish and the long hairs, up to 34 mm., are harsh and dead; the pattern is normally dark and well defined.

Sohagpur, Hoshangabad, 1,000 ft., in Central India. Two males collected on April 11 and 12. The coat is harsh and short, measuring about 30 and 34 mm. In one the pattern is black and well defined; the head and forequarters are buff, but the hind body has the interspaces bleached whitish. In the other the hair is moulting on the shoulders and neck and is everywhere bleached and whitish, the pattern being diluted by rusty ochreous speckling.

Sehore in Central India, some 50 miles North of Hoshangabad. A single specimen collected by C. H. Whitehead on July 21 is greyish buff, with the pattern black, closely resembling the first-described example from Hoshangabad. The coat is thin and short, about 22 mm.

Palanpur in Gujerat, 150 ft. A young female collected on March 22 has the coat full, soft and from about 30-35 mm. long; the interspaces are silvery grey and the pattern is ochreous and poorly defined; the tail is well tinted with ochre.

Danta in Gujerat, 1,000 ft. One specimen (June 20) differs greatly from the last in its strong, sharply defined black pattern and thin, short coat measuring about 20 mm.; but the interspaces are whitish. This specimen is very like the one from Sehore collected in July.

Rajkote, Kathiawar, 100 ft. (December 10). A young male resembling the example from Palanpur in its full, soft coat measuring about 35 mm., and the interspaces whitish, but the pattern has more black in it and is more emphasised. An adult female from the same locality (December 25) has the coat about 30 mm., but the ground colour is more buffy and the pattern of the back is irregular and a mixture of rusty ochre and black.

The following are the flesh-measurements in English inches and the weights of four of the adult specimens recorded above:—

Locality and Sex	Head and Body	Tail	Weight
Hazaribagh ♂	$23\frac{3}{5}$	$16\frac{4}{5}$	$6\frac{1}{4}$ lbs.
,, ♀	$21\frac{1}{5}$	15	6 ,,
Kathiawar ♀	$22\frac{1}{5}$	$15\frac{1}{5}$	$5\frac{3}{4}$,,
Gujerat ♀	$20\frac{1}{5}$	16	$5\frac{1}{2}$,,

These dimensions show no superiority in size to those of examples from Dharwar described as *indica*. The same applies to the skulls. Robinson and Kloss found that skulls of *bengalensis* from Calcutta measured 103 and 105 mm. (=4.2 in.), whereas those of *indica* from Dharwar were 94 and 95 mm. (=3.8 in.) in total length. They therefore inferred that *bengalensis* was a bigger animal. But the only skull from Calcutta in the British Museum, probably that of an adult ♂, and the skull of an adult ♂ from Hazaribagh are 3.9 in., which is about the average of ♂ skulls from Dharwar, and the largest ♂ skull from Dharwar is 4.1 in. I have also failed to find even an average difference between the bullæ of the Bengal and Dharwar examples, such as Robinson and Kloss claimed to exist.

The specimens provisionally assigned to this race occur on approximately the same latitude from Calcutta to Gujerat. They are on the average decidedly greyer and paler than the more southern Indian specimens described as *indica*, and none of them exhibits the dark olivaceous or ochreous brown hue of some examples of *indica*. On the other hand some of the grey examples of *indica* are practically indistinguishable from them.

Possibly this race extends to the west of Gujerat as far as Sind. At all events Mr. S. H. Prater secured a skin, without skull, date or measurements, at Nanderoo, Larkhana in Sind to the west of the Indus. The general colour is pale grey, with the pattern deep brown; but the coat is shaggy, harsh, thin and longish, measuring

38 mm. In the colour, texture and length of its coat this specimen closely resembles the two examples of *indica* killed in May at Kurnool and described above. Whatever its name may be, this specimen is of great interest as disproving Blanford's assertion that *Viverricula* is not found in Sind.

It cannot be claimed that the following table of measurements of the skulls from scattered localities assigned to this race, supplies satisfactory data by which they can be distinguished from the skulls of *V. indica indica*. More material is clearly required to settle the point. The skull from Hoshangabad is exceptionally short and narrow and has a small carnassial for an adult male; and the average size of this tooth in all the specimens is less than in those from Dharwar; but I cannot substantiate the claim of Robinson and Kloss that the skull is larger and has longer, higher and less compressed bullæ than in *indica*.

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
bengalensis.							
Calcutta. ad. ♂	3·9	1·9	·5	·7	20	7	8×5
Hazaribagh. ad. ♂	3·9½	1·8	·4½	·6	19	6	8×5
Sehore, C. India. old. ♂	4·0	1·9½	·5–	·7	19	7	8×6–
Hoshangabad. ad. ♂	3·6	1·6½	·5	·6	19	7	7½×4
Danta, Gujerat. ad. ♀	3·8	1·7	·5	·6–	19	8	7½×5
Kathiawar. ad. ♀	3·8	1·7½	·5	·6	18	7	8×5
deserti.							
Rajputana (type) ad. ♂	3·9½	1·7½	·3½	·6	18	·5	8×5
? subsp.							
Dagshai, Upper Punjab ad. ♂	3·6½	1·6	·4	·6	16	7	7×4

VIVERRICULA INDICA DESERTI, Bonh.

Viverricula malaccensis deserti, Bonhote, *Ann. Mag. Nat. Hist.* (7), i, p. 120, 1898.

Locality of type: Sambhar, nr. Jaipur in Rajputana.
Distribution: Rajputana, so far as at present known.

The type of this race, an adult ♂ collected on December 17 by R. M. Adam, has a luxuriant coat with plenty of dark grey underwool, the long hairs being some 45 mm. long. The general colour is decidedly grey. The stripes and spots form an obscure irregularly clouded pattern, a mixture of grey, ochreous and dusky brown, but no real black. The flesh-measurements are: head and body just under 23 ins., tail 15 4/5 in.

A second specimen, collected in August at Nusserabad in Rajputana by Major J. W. Yerbury, has the coat very similar to that of the type, thick and long measuring 42 mm. in length. The general colour is also pale but washed with buff and not so grey. The pattern also is obscure, mixed black and rusty ochre, but forms hardly any definite stripes.

Although only these two specimens are known from Rajputana, they appear to deserve the subspecific status given to them by Bonhote on account of the extreme length of the coat which is much longer and shaggier than the coats of the specimens assigned to *indica* and *bengalensis* obtained in the same, or nearly the same, months of the year. It is remarkable too that the coat of the example killed in August is almost as long as that of the example killed in December, assuming the dates to be correct.

The only known skull of *deserti*, of which the dimensions are given above, is remarkably narrow in the waist, noticeably narrower than in *indica* and *bengalensis;* and this difference does not appear to be a question of age. In other respects the measurements agree tolerably well.

I have also added to the table of the skull-measurement of an example from Dagshai, near Simla, 6,000 ft. (*Major H. N. Dunn*) which I cannot classify. The skull, that of an adult ♂, is short and narrow, as in the example assigned to *bengalensis* from Hoshangabad; but the waist is narrower, the carnassial tooth smaller, although not from wear, and the bullæ shorter. The skin, dated January 26th., has a good coat, 38 mm. long, the general colour is decidedly grey with the pattern black and sharply defined, as in the examples identified as *bengalensis;* the flesh measurements are: head and body 22¼ ins., tail 13¼ ins. From its locality this specimen should belong to the form described next; but the general colouration is very different and the skull, including the upper carnassial tooth, much smaller. More material from the Upper Punjab is clearly needed to settle the identity of this specimen.

VIVERRICULA INDICA WELLSI, subsp. nov.

Locality of type: Kangra, 2,000 ft. in the Upper Punjab.
Distribution: Kangra, Kumaon and 'United Provinces'.

Description: Resembling *deserti* from Rajputana in the coalescence and confusion of the dorsal pattern, but differing in being on the average more richly tinted, none of the specimens in full winter coat (February and March) exhibiting the whitish hue of the type of *deserti* from Jaipur, although the greyest of them nearly matches the example of that race from Nusserabad collected in August.

From the specimens assigned to *bengalensis* and *indica*, the skins differ in being on the average much brighter in hue and in the indistinctness of the pattern.

Some notes on topotypical examples from Kangra are here given. They were collected for the Mammal Survey by Mr. H. W. Wells.

The largest specimen, March 25, is ticketed ♀ but is, I suspect, a ♂. The pattern is very obscure owing to its ochreous tinge blending with the buff hue of the hairs of the interspaces, which, however are bleached basally. A second specimen, collected on March 25, and a third collected on February 27, closely resemble the first in colour and pattern but are in better coat. Another ♂, March 25, is not so richly coloured, the interspaces being bleached and whitish grey. The larger of two females, March 27, is richer coloured owing to the pattern being rusty ochreous in tint. The smaller female, March 25, on the contrary has the pattern blacker and more distinct than in the rest.

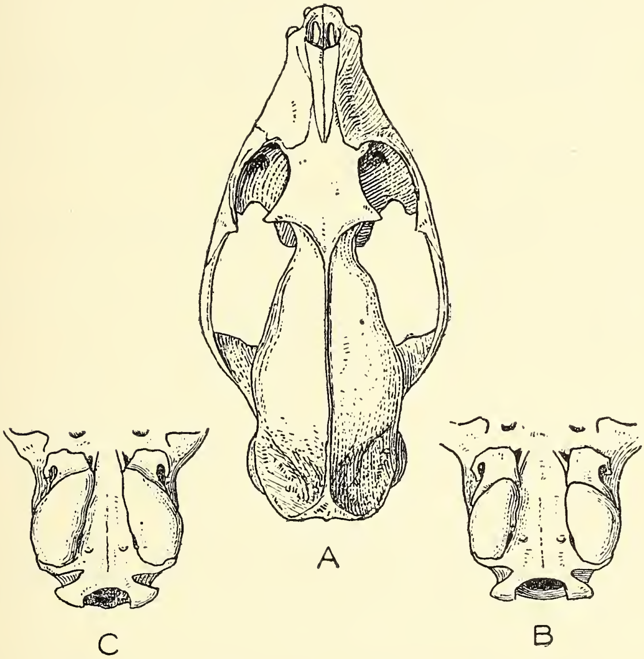

Fig. 5.—A. Upper view of skull of *Viverricula indica wellsi* from Kangra. B. Lower side of occipital region of the same. C. The same of *V. indica baptistæ* from Bhutan Duars.

In addition to the six Kangra specimens, two were procured at Ramnagar in Kumaon, 1,500 ft., by C. M. Crump. One, an adult ♀, collected at Jerna, Jan. 21, closely resembles the typical Kangra skins in colour and pattern, the dorsal surface presenting an irregularly mottled appearance of buff, ochre and black, the interspaces being buff and pattern black diluted with ochre. The other specimen, a half-grown ♂, from Dela, January 9, shows the same disintegration of its dorsal pattern, but, being blacker, the pattern is more conspicuous.

A series of ten flat skins, ticketed 'United Provinces' but without skulls or further particulars, sent by R. St. George Burke, seem to belong to this race. The coat in all is full, soft and long, from 35 to 40 mm. They are mostly well coloured, rich ochreous buff, but in some the ends of the hairs are bleached to greyish. The pattern varies from blackish to rusty, but, even when blackish, the dorsal stripes mostly lack definition, being narrow and confluent and not arranged in 5 or 7 distinct bands as in *indica* and *bengalensis*. In this respect, as in colour, these skins resemble those from Kangra.

The coat measurements in millimetres of some of the examples referred to above are as follows:—

Locality and Sex	Date	Back	Flank	Tail
Kangra ♂	February	45	42	43
,, ♂	March	46	35	38
,, ♂	March	42	41	41
,, ♂	March	40	35	39
,, ♀	March	35	29	35
Kumaon ♀	January	40	34	38

The following are the flesh measurements in English inches of six specimens and the weight of one:—

Locality and Sex	Head and Body	Tail	Weight
Kangra ? ♂	26	11	...
,, ♂	25	14	...
,, ♂	24	15	...
,, ♀	22	14	...
,, ♀	21	13	..
Ramnagar, Kumaon ♀	22	14	6½ lbs.

These measurements suggest that *wellsi* is about the same size in the head and body as *indica*, slightly larger than *bengalensis*, but has a relatively shorter tail than either.

Of the previously described races of *V. indica*, *wellsi* most nearly resembles in external features the two Chinese races recorded below, especially the southern Chinese form *pallida;* but the pattern is on the average more distinct and the tail is less bushy.

The subjoined table of measurements suggests that the skulls of adult males of this race are on the average slightly larger than those of *indica*, *bengalensis* and *deserti*, with the waist narrower than in the first two, a trifle wider than in the last; that the carnassial tooth is about the same as in *bengalensis* and *deserti*, smaller than in *indica*, more particularly the Dharwar examples, and that the bulla in the typical examples from Kangra is shorter than in *bengalensis*, about the same as in the two others, but more constant in size than in *indica*.

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
Kangra. ad. ♂	4·1½	1·9	·4	·7	...	...	8×5
,, (type) ad. ♂	4·0	1·9	·4½	·6+	18	8	,,
,, ad. ♂	4·0	1·8	·4+	·6½	...	...	,,
,, ad. ♂	4·0	1·8	·4½	·6	18	7	,,
,, ad. ♀	3·9½	1·8	·4½	·6	18	8	8½×5
,, ad. ♀	3·8	1·8	·5–	·6+	17	9	8×5
Ramnagar, Kumaon ad. ♀	3·9	1·8	·4½	·6	19	6	,,

VIVERRICULA INDICA BAPTISTÆ, subsp. nov.

Locality of type: Hasimara in Bhutan Duars.
Distribution: From Bhutan and Upper Bengal to Assam.

Description: Nearly resembling the well-coloured Kangra and Kumaon skins in the buff or ochreous tint of the interspaces but hardly so bright and differing in the distinctness of the pattern and the shorter, fresh winter coat. The coat is also a little shorter than the fresh winter coat of the southern Indian form *indica*, and the colour on the average is richer, more tawny ochreous. The difference in colour is still more marked in comparison with the skins assigned to *bengalensis*.

Hasimara and Bharnabari in the Bhutan Duars, 600 ft., (C. A. Crump and N. A. Baptista). Nine skins of various ages collected between November 7 and March 29. The coat is full and soft in all, averaging 30 mm. in length in six adult or subadult specimens. The general tint of the interspaces is dull ochreous buff, three of the richest tinted skins being dated November 14, January 9 and February 20; but some skins are more olivaceous and darker owing to dusky speckling on the buff, notably in two dated November 7 and January 16. Only one skin approaches grey. This is dated March 29 which suggests bleaching as the cause of the paleness, but it has the same date as one of the richest tinted skins mentioned above. The pattern in all is distinct, blackish or brownish, sometimes a little diluted with ochreous. The under side is buff or grey. The tail, which has from 8 to 10 rings, varies in the amount of buff on the pale rings, but is usually well coloured.

The following specimens also match the Bhutan skins:—

Haldibari in Bengal, near Cooch Behar (*C. A. Crump*), April 20. A young female with the coat soft and 27 mm. long.

Bahgownie in Dharbanga, Bengal, 150 ft., December 13. (*C. M. Inglis*). One male is indistinguishable from the Hasimara skins; but a second, with the same date, is paler and greyer, with the coat thinner, coarser and shorter, only 20 mm. long. Probably the date is wrong.

Angara Khata in North Kamrup, 300 ft., December 5 and 14, (*H. W. Wells*). Two skins exactly match some of the Hasimara skins. The coat is full and 31 mm. long; the colour is ochreous and the pattern blackish brown and distinct.

A few skins from Assam, all, with one exception, known to have been collected in the winter months, with the colour varying from rusty ochre to pale ochreous buff, without any grey, and the pattern distinctly defined, attest the extension of this type to the south and east of the Brahmaputra.

Mokokchung in the Naga Hills, 4,500 ft., January 8. ♂. More richly coloured than most, but not all of the skins from Bhutan described above, with bright ochreous interspaces and well-defined black pattern; the coat full and soft, up to 35 mm. in length. A female, February 3, is also decidedly ochreous but not so rich in tint as the male; the coat is full but, in the young, only 26 mm.

Sadya. A skin, without date or measurements, given to W. T. Blanford by J. Cockburn, is paler ochreous than the Naga Hills specimens; since the coat is full and soft and 30 mm., this is no doubt a winter skin.

Rasirunga in Golaghat, 250 ft., January 20. Like the Sadya specimen in colour but the pattern more rufous; coat 27 mm. A second specimen, a young one, is a little paler than the last but not grey; the coat is full and soft and 30 mm. long.

Coat measurements in millimetres of some winter skins:—

Locality and Sex	Date	Back	Flank	Tail
Bhutan Duars	Nov. 7	32	29	28
,,	Nov. 14	28	25	20
,,	Dec. 10	30	27	23
,,	Feb. 20	30	27	26
,,	Mar. 29	27	24	21
,,	Mar. 29	31	26	27
Haldibari	Apr. 20	27	20	23
Bahgownie	Dec. 13	28	25	21
N. Kamrup	Dec. 14	28	27	25
Naga Hills	Jan. 8	31	26	27

Dimensions in English inches:—

Locality and Sex	Head and Body	Tail	Weight
Mokokchung, Naga Hills ♂	22½	16	...
N. Kamrup ♂	21⅕	13⅗	6 lbs.
Bhutan Duars, Bharnabari ♂	20⅖	13⅕	...
Bhutan Duars, Hasimara ♂	20	13⅕	...
,, ,, ,, ♀	20⅖	11⅖	...
Bhutan Duars, Hasimara ♀	20	12⅖	...

These dimensions indicate a smaller race than the southern Indian forms *bengalensis* and *indica* and than the western Himalayan form *wellsi*.

A few old skins, without particulars, from Nepal (Hodgson) seem to belong to this race rather than to the Kangra form judging from the comparative shortness of the coat and distinctness of the pattern. The general colour is very variable, no two being alike.

The skulls of this race, as shown by the following table, are noticeably shorter and narrower than in the Kangra race, with the waist and maxillary width about the same, but the bullæ decidedly longer and less widely separated anteriorly. The waist is narrower than in *bengalensis* and *indica* and the bullæ are also slightly larger and closer together at their nearest point. In one example the waist is actually as narrow as in *deserti;* but the skull is much shorter and has actually longer, relatively much longer, bullae (Text-Fig. 5, B.C. p. 641).

Five adult but unsexed skulls collected by Hodgson in Nepal vary in total length from 3.6 to 4.1 in., in zygomatic breadth from 1.7 to 1.8, in waist from 3¼ to 4, in maxillary width from .6 to .7, in length of bullæ from 18 to 21 mm., in space between them from 5½ to 7 mm., and in the size of the carnassial from 7×5 to 8×5 mm. The 'pinching of the waist' is even more pronounced on the average than in *baptistæ* and the bulla is almost the same in length; but in other particulars these skulls are about intermediate between *baptistæ and wellsi*, as might be expected from their locality.

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
Bhutan Duars (type) ad. ♂	3·9½	1·7–	·4¾	·6	21	5	8×5
Bhutan Duars ad. ♂	3·8	1·7	·4½	·6	20	6	8×5
,, ,, ad. ♂	3·6½	1·6	·3½	·6	20	6	8×5
,, ,, ad. ♀	3·6½	1·7	·4	·6	20	6	7×5
,, ,, ad. ♀	3·5½	1·7	·4	·5½	20	6	8×5
Darbanga. ad. ♂	3·6½	1·6	·4	·6–	19	6	8×5
Angarakhata, S. Kamrup. ad. ♂	3·6½	1·8	·5	·6	20	6	8×5

VIVERRICULA INDICA PALLIDA, Gray.

Viverra pallida, Gray, *Proc. Zool. Soc.*, p. 63, 1832, (no description); *Ill. Ind. Zool.* ii, pl. vi, 1834.

Viverricula pallida, Bonhote, *Ann. Mag. Nat. Hist.* (7), i, p. 120, 1898 (in part), B. Howell, *Proc. U. S. Nat. Mus.* 75, p. 31, 1929.

Viverricula malaccensis pallida, G. M. Allen, *Amer. Mus. Novit.*, No. 359, p. 3, 1929 (in part).

Locality of type: China, probably Canton.
Distribution: Southern China and Formosa.

The following skins in the British Museum are assigned to this race:—

Canton (probably). The type of *pallida*, unsexed and undated. (J. R. Reeves). Pattern not well defined, the stripes on the back and spots on the flanks brown, a mixture of black and rusty-ochre, not thrown clearly into relief by the buffish grey ground-colour; no transverse stripes on the throat and no spots on the shoulders. Tail with nine dark, brownish rings. Hairs on back 37 mm., on flank 35 mm., on tail 33 mm.

Hong Kong. Nov. 12 (*Capt. A. G. Ferguson*). A young specimen almost exactly resembling the type in colour and pattern. Hairs on back 34 mm., on flanks 34, on tail 28.

Amoy. Apparently ♂. Undated. (*R. Swinhoe*). Pattern rather brighter than in the type and more conspicuous, the ground-colour being greyer; tail with seven, perhaps eight, dark rings. Hairs on back 46 mm., on flanks 46, on tail 51.

Foochow. Nov. (*R. Swinhoe*). Pattern bolder than in any examples of this race I have seen, consisting of sharply defined black stripes on the back and of spots on the flanks, showing up clearly against the grey ground-colour which nearly resembles that of the example from Amoy. Coat short, with less underwool; hairs on back 30 mm., on flanks 28 mm., on tail 21 mm.

Formosa, Lauloni in the mountains of the centre of the island. ♂. December 19. (*P. A. Holst*). Ground-colour greyish as in the Amoy example but the pattern bolder, with more black and rusty-ochre in it. Tail with nine dark rings. Hairs on back 33 mm., on flank 32, on tail 28 mm.

Formosa, northern district of island. Unsexed and undated. (*R. Swinhoe*). Ground-colour greyish, almost as in the example from Amoy but a little greyer and therefore throwing the brown pattern into stronger relief. Tail with eight dark rings. This skin is paler than Holst's example from Lauloni, the pelage having less black and less rusty-ochre, and being not so strongly speckled. Hair on back 30 mm., on flank 30 mm., on tail 30 mm.

Schwarz (*Ann. Mag. Nat. Hist.* (8), 6, p. 637, 1910) gave the name *taivana* to some Formosan specimens which he described as differing from *pallida* by their shorter coat, more distinct pattern, brighter ground colour and quite differently shaped bullæ. These differences do not exist between the Formosan and Southern Chinese specimens I have seen.

VIVERRICULA INDICA HANENSIS, Matschie.

Viverricula hanensis, Matschie, Chin. *Säug. Filchner Exped.*, p. 196, 1907; Mell, *Arch. Naturg.*, 88, pt. 10, p. 20, 1922.

Viverricula pallida, G. M. Allen, *Mem. Mus. Comp. Zool.*, Harvard, 40, No. 4, p. 236, 1912; *id. Amer. Mus. Novit.*, No. 359, p. 3, 1929 (in part).

Locality of type: Hankow (restricted by Allen).

Distribution: The watershed of the Yangtse.

Note on the synonymy: Matschie gave the name *hanensis* to two skins from Hankow and Kiang-Si. Allen subsequently cited

Hankow as the locality of the type. Matschie described these skins as differing from those he identified as *pallida* by the absence of oblique bands on the shoulders, the presence of six conspicuous bands on the hind back and of eight, not six, dark bands on the tail, these bands being narrower than the pale bands and not narrower than the white tip. Allen discarded *hanensis* as a synonym of *pallida* on the evidence of a skin from Ichang in Hupeh. I am entirely in agreement with Allen in regarding the alleged distinctive features of *hanensis*, mentioned by Matschie, as systematically valueless; but I refer to *hanensis* the following skins in the British Museum because of their occurrence in the valley of the Yangtse and because they seem to differ in their more luxuriant winter coat from examples collected farther south in China which I assign to *pallida*.

Nankin. ♀ ad., November 28, (*E. B. Howell*). Pattern rather indistinct, consisting of stripes and spots mostly ochreous and not sharply defined against the greyish-buff ground-colour; tail with seven, perhaps eight, dark rings, consisting of black, rusty-tipped hairs. The hairs on the back 56 mm., on the flanks 41, on the tail 45.

Nankin. ♂ ad., November 9, (*E. B. Howell*). Pattern with more black in it than in the ♀ and showing up more conspicuously partly on that account and partly because the ground-colour is a good deal greyer; the dark stripes of the tail, eight in number, are also blacker with less rusty dilution and the pale bands are whiter with less buff. This is a handsomer skin than the female on account of its bolder pattern, but it is less richly tinted, less affected by 'erythrism'. Hair on the back about 59 mm., on the flanks 47 mm., on the tail 47 mm. Flesh measurements: head and body 26 in., tail 12 3/5 in.

Shanghai. December (*F. W. Styan*). A half-grown specimen as shown by the skull. In its general buffy-ochreous hue closely matching the female from Nankin; but the pattern is more broken up and confluent, the back being mottled rather than banded. Hair on back 42 mm., on flank 40 mm., on tail 36 mm., shorter than in the Nankin specimens probably because of the immaturity of the specimen.

Chung Yang in South Hupeh. January 13 (*F. W. Styan*). A young specimen, about the same age as the last judging by the skull. General hue like that of the male from Nankin; but the pattern mottled as in the specimen from Shanghai. Hair on back 50 mm., on flanks 45, on tail 45.

China. Undated. (*Fortune*). A well tinted specimen almost exactly matching in colour and pattern the female from Nankin, but with the ochreous buff pervading the belly and throat. Hairs on back 53 mm., on flanks 48 mm., on tail 47.

Of the above-described specimens the only one measured in the flesh is the male from Nankin which is considerably larger than the specimen from Ichang recorded by Allen, in which the head and body were 21 3/5 in., the tail 11 3/5.

The British Museum has only a few skulls of the two Chinese races of *Viverricula* here admitted provisionally and most of them are unsexed, immature or imperfect in the occipital region. The following measurements, however, are perhaps worth recording:—

	In English inches					In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Mand. width	Max. length	Bulla	Space between bullæ	Upper Carn.
hanensis								
Nankin City ad. ♂	4·2	1·9	·6	·7	3·0	21	8	9×6
,, ,, ad. ♀	4·0	1·8	·5	·7	2·8	21	8	8×5
'China' (Cuming) ? ♂	—	2·0	·5	·7	2·9	—	—	9×5½
pallida								
[1] Canton (type) yg. ? sex	3·7	1·7	·5	·6	2·5½	17	7	—
Foochow ad. ,, ,,	—	1·9	·5	·6	2·6½	—	—	8×5
Formosa (Holst) ad. ,, ,,	3·7	1·7½	·5½	·6	2·6½	17	9	8½×5½
,, (Swinhoe) yg. ,, ,,	3·7	1·6½	·5	·6	—	18	9	—

The data this table supplies are insufficient to establish definite differences[2] between the two Chinese forms. They suggest, however, that *hanensis* is larger in the skull than *pallida;* but the range of variation is not greater than in the specimens assigned to the following race, *thai.*

The skulls of *hanensis* are about the same in length and zygomatic width as those of *wellsi* from Kangra, a little larger if anything, the waist is a trifle wider, and the bullæ longer with the same distance between them.

They are larger in every respect than in *baptistæ*, the difference in the space between the bullæ being marked, although in actual length the bullæ are nearly the same in the two.

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[1] This skull and the one procured by Swinhoe in Formosa, which are about the same age, still carry the milk teeth. They are a good illustration of the retention of the first dentition until the skull has almost attained its full size, a phenomenon common in the civets and distinguishing them from the cats.

[2] The American Museum of Natural History is the only institution which possesses the material to settle this point as regards both external and cranial characters; but although G. M. Allen from examining this material decided that examples from Laos and other parts of southern China belong to the same race as those from the Yangtse Valley, it is possible that detailed measurements of the skulls and of the coat in dated skins may bring out average differences between the two such as are suggested by the British Museum material.

The skull of *pallida* seems to be about the same size as in *baptistæ*, but the waist is wider and the bullæ are noticeably smaller and more widely spaced.

VIVERRICULA INDICA THAI, Kloss.

Viverricula malaccensis thai, Kloss, *Journ. Nat. Hist. Soc.*, Siam, 3, p. 352, 1919; Robinson and Kloss, *Rec. Ind. Mus.* 19, p. 178, 1920.

Locality of type: Prapatom about 40 miles W. of Bangkok, Siam.

Distribution: Siam, Indo-China and possibly Burma.

This race was diagnosed by comparing it with examples regarded as typical *malaccensis* from Malacca, the size and pattern being the same but the 'buffy ground colour' slightly paler and duller with more black speckling and the tail more nearly white. There are also some alleged cranial differences referred to below.

I have not seen the type of this race, nor examples from Prapatom or very near it; but the British Museum has a good skin from the Me Wang River, 700 ft., 60 miles north of Raheng in Siam, which is no doubt referable to it. This skin collected in February has a full, thick coat; the general colour is buffy grey, not so bright as in Malayan specimens; the pattern is tolerably well defined, mostly rusty-ochre but blacker on the mid-line of the hind back; the tail has 7 blackish bands with a long white tip.

The following skins in the British Museum from Indo-China (Delacour and Lowe) and referred by Thomas and Osgood to *V. malaccensis*, without subspecific designation, I assign to this race:—

Two from Saigon, Cochin China, January. One is slightly more buffy than the example from Raheng, with the pattern the same; the other is much greyer, with practically no buff tint. The coat is shorter than in the Raheng specimen.

One from Kratie, Cambodia, February, has rather a coarse, shabby coat, but it almost matches the Raheng specimen, being merely a little greyer.

Annam. Four skins. A male from Dak-To, March, is grey like one of the Saigon skins, greyer than the Raheng skin and with the pattern blacker, less rusty. Another male from Thuy-Ba, Quangtri, is grey like the last. Both have the coat long and full. A specimen from Nahtrang (*Dr. Vassal*) is grey like the last with rusty black pattern; but the coat is short and comparatively thin and sleek; no doubt a summer skin. The fourth specimen, also a ♂, apparently from Pakha, is more richly tinted than the others, buffier than the example from Raheng, and has the pattern blacker. diluted with ochreous rather than rusty speckling; the dark bands on the tail also are blacker and the white bands even to the tip washed with buff. The example from Raheng is intermediate in tint between this brighter coloured example and the grey specimens.

Two from Tonkin. A young male from Langson, 500 ft., is a little better coloured than the Raheng skin, very like the brighter Saigon skin, but not so well tinted as the one from Pakha, Annam.

A kitten from Chapa, on the contrary, is a richer ochreous buff than any of these Indo-Chinese skins.

The following are the coat measurements in millimetres of some of the skins:—

Locality	Date	Back	Flank	Tail
Raheng, Siam	Feb.	40	35	35
? Pakha, Annam	Jan.	40	35	38
Dak-To, ,,	March	43	31	33
Quangtri ,,	,,	41	37	...
Nahtrang	(Summer)	25	22	25

Kloss suggested the possibility of the extension of *thai* into Burma. The material in the British Museum from that country is unfortunately too meagre to settle the question definitely; but a few skins, mostly from Upper Burma, seem to agree with Indo-Chinese skins better than with skins from Assam and the Malay Peninsula. At all events in the decoloration and defective black banding of the end of the tail and in the longer, looser winter coat they differ from the Assamese and Bhutan Duars skins described above as *baptistæ*.

The Chin Hills, 4,000 ft. in Upper Chindwin, 50 miles west of Kindat (*J. M. D. Mackenzie*). A flat imperfect skin, April 15, almost exactly matches in coat and colour the brightly coloured skin from Saigon in Cochin China referred to *thai*, the general colour being bright and buffy, the pattern rusty, the coat full and loose, 38 mm. on the back and flanks and 33 on the tail, thus agreeing closely with winter Indo-Chinese skins.

Yin in Lower Chindwin (*G. C. Shortridge*). A flat skin, dated September 18, in rather poor coat, resembles in the blackness of its pattern and the greyness of the flanks the skin from Thuy Ba, Quangtri, Annam, recorded above; but in the brownish hue of the head and shoulders, due to buffy speckling of the hairs, it is like the examples from Langson in Tonkin and Kratie in Cambodia. The coat is shorter than in the winter skins assigned to *thai*, being 33 mm. on the back and flanks and 34 on the tail.

Mt. Popa, 4,961 ft., ♂, September 5; and Allagappa Valley, 30 miles W. of Sagaing, October 13 (*G. C. Shortridge*). From their localities it may be inferred that these skins belong to the same race as the one from Yin in Lower Chindwin[1], but the coat is short, thin, harsh and bleached on the flanks to whitish grey, the pattern being blackish and sharply defined.

The localities of these skins are drained by the Irrawaddy or its tributaries, and from Rangoon on the delta of this river the

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[1] Two imperfect skins from Pokokku, identified by T. B. Fry as *V. malaccensis*, are skins of the Bengal Cat (*Prionailurus bengalensis*).

British Museum has a skin, presented by Col. Harrington, which is in good pelage and resembles in general coloration the head and shoulders of the specimen from Yin in Lower Chindwin and would pass as an unbleached representative of the skins from Mt. Popa and the Allagappa Valley. It is strikingly different in tint from the series of skins from the delta of the Sittang river referred to below under the Malayan race. Probably Lower Burma is the district where these races pass into one another.

In his description of this race Kloss distinguished the skull from that of the Malayan race he regarded as typical *V. malaccensis* by the greater anterior distance between the bullæ which in his two old ♀ specimens of *thai* from Prapatom was respectively 8.7 and 8.3 mm., indicated on my table as 8½+ and 8½— mm., the corresponding measurements of two specimens from Malaya being 7.3 and 6.9, averaging 7. In the rest of the specimens entered in my table the dimension in question is the narrowest space between the bullæ, possibly not quite the same as that quoted by Kloss. Nevertheless the examples from Tonkin, Annam and Sagaing agree tolerably closely with the two skulls of *thai* from Prapatom in that and other respects. On the other hand the skulls from Mt. Popa, Chittagong, Rangoon and Cochin China resemble the examples from Malaya recorded below in the interbullate distance. The differences between the bullæ in the skulls from Mt. Popa and Sagaing are instructive, since the localities are not far apart. They may be compared with the similar differences exhibited by the skulls of typical *V. indica* from Dharwar. Both races show more fluctuation in the length of the bullæ and the distance between them than is usual. The skulls on the whole are very similar; but the Indian skulls on the average are a little shorter and narrower, but wider in the waist, the carnassial tooth being about the same. So far as it is possible to judge from the scanty material, there seems to be no difference of moment between the skulls from Nankin referred to *hanensis* and those of *thai*.

Cranial measurements of the specimens identified as *thai*:—

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
Langson, Tonkin, ad. ♂	4·1—	1·8	·4	·6½	20	8	8×6
,, ,, ,, ♂	4·1	1·7½	·4½	...	19	8	8×5
Quangtri, Annam, ad. ♂	4·1	2·0	·4½	·7	17	8	9×6
Mt. Popa, Upper Burma, ad. ♂	3·9	1·8½	·5	·6½	18	7½	9×6
W. of Sagaing, Upper Burma, subad. ♂	4·0	1·8	·5	·6½	20—	9	8×6

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Width waist	Max. width	Bulla	Space between bullæ	Upper Carn.
Chittagong, ad. ♂	4·2	1·9	·5	·7	22	7	8½×6
Rangoon, ad. ♂	4·0	1·8	·5	·6	22	7	8×5½
Chittagong, ad. ♀	3·9	1·8	·5	·6	19	7	7½×5
Prapatom, Siam (type) ad. ♀	3·9	1·8	...	...	...	8½+	...
Prapatom, Siam ad. ♀	3·8	1·8	...	...	...	8½−	...
Phurieng, Cochin China, ad. ♀	3·9	1·7½	·4½	·6½	17	7½	8×6
Indo-China, (Delacour) old ?♂	4·0	1·9	·5	·7	19	8	8×5

Note on the Viverricula of Hainan: In his paper on the Viverridæ of Southern China, G. M. Allen (*Amer. Mus. Novit.*, No. 359, p. 3, 1929) assigned to typical *V. m. malaccensis* a series of 20 skins from Hainan which were distinguished from the Chinese race identified as *V. m. pallida* by being 'uniformly slightly smaller in size of skull, and, with one exception, representing the grey phase of pelage, while the others [*pallida*] are larger of skull, have longer tails and are practically all of the rufescent type'. I expected to find the specimens from Annam and Tonkin in the British Museum in agreement with the Hainan specimens referred to; but the Tonkin skins are better coloured and although the grey phase is evidently not uncommon in Annam, the skulls of these Indo-Chinese examples are on the evidence I possess larger than in the Hainan series, in which the average condylo-basal length of five adults is only 95½ mm., whereas the same dimension in an adult male skull from Quangtri in Annam is 101 mm. and in an adult and a subadult skull from Langson in Tonkin it is 103 mm. and 98 mm. respectively. These three skulls thus agree tolerably closely in length with those of ten adult male skulls from China, assigned by Allen to *pallida*, in which the average condylo-basal length is just under 101 mm.

I may add that the adult male and female skulls from Nankin, assigned by me to *hanensis*, are 106 mm. and 101 mm. respectively in condylo-basal length, whereas the only adult and complete skull I possess of the form identified as *pallida*, namely, the skull from Lauloni in Formosa (Holst), is only 92 mm., suggesting that it comes into the same category as the Hainan series. My material is insufficient to elucidate the question further.

VIVERRICULA INDICA KLOSSI, subsp. nov.

Viverricula malaccensis malaccensis, Kloss, *Journ. Nat. Hist. Soc. Siam*, 3, p. 352, 1919; Robinson and Kloss, *Rec. Ind. Mus.*, 19, p. 178, 1920. (Not *Viverra malaccensis* Gmelin.)

Locality of type: Pinang.

Distribution: Malay Peninsula, extending northwards apparently into Lower Burma.

Description: Distinguished from *V. indica thai* and the other races hitherto described by its brighter or better pigmented pelage, the ground colour varying from bright yellowish buff to buffish brown with no grey upon the dorsal side or flanks; pattern distinct, blackish brown to rusty brown.

I have seen the following three examples from the Malay Peninsula:—

Pinang (Type B.M., Dr. Cantor. 79.11.21. 277). A good but unmeasured, undated skin ticketed ♂, but obviously ♀ by the mammae, and tolerably old, judging from the fused sutures of the skull. General colour buffy brown, decidedly darker and browner than the skin from Raheng in Siam identified as *V. indica thai*, with no grey speckling in the pelage except on the under side; the pattern well defined and dark brown; coat comparatively short. Judging from its tint this specimen seems to resemble tolerably closely a poor skin, not preserved, from Patani on the eastern side of the Malay Peninsula, noted by Robinson and Annandale as 'greyish brown' and referred to by Bonhote (*Fasc. Malay.*, pt. i, p. 9, 1903).

A second ♀, subadult, from Pinang (*E. J. House*) is not so dark, the general hue being rather lighter and buffier, and the well-defined dark pattern considerably diluted with rusty ochre; the coat also is somewhat longer. It is decidedly buffier and less grey than the specimen of *thai* from Raheng.

The third specimen, ♂, from Taiping, Perak, collected in June by Seimund, identified by Kloss as typical *malaccensis* and belonging to the Federated Malay States Museum, is very like the last-described skin from Pinang, but is still brighter in hue, the ground colour being a slightly yellower buff; the coat is soft and tolerably short.[1]

Evidence for the extension of this race northwards through Tenasserim into Lower Burma is supplied by six flat, unmeasured skins, dated March 4, procured for the Survey by Mr. J. M. D. Mackenzie at sea-level in the delta of the Sittang River, 40 miles south of Pegu town. They are practically indistinguishable from the brighter Malayan skins from Pinang and Perak recorded above, but brighter than the type from Pinang. The coat (March) is decidedly less luxuriant and shaggy than that of the Raheng skin and the Annam skins collected in January, February and March, assigned to *thai;* the ground-colour in all is buff or ochreous, varying a little in richness, two being duller and paler in tint than the rest; the pattern is well defined, varying from blackish to rusty black; the tail has 7 or 8 dark rings and is noticeably white terminally.

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[1] These specimens and Kloss's remarks about others from the Malay Peninsula bear out the statement made above that there is at present no evidence of specimens from that district being 'pearly grey' with a black pattern, like Sonnerat's alleged 'Civette de Malacca', the type of *malaccensis* Gmelin. Sonnerat also described the summit of the head as black and the belly as marked with a median band from the chest to the genitalia, and his figure shows 10 distinct black rings on the tail. There are usually only 7 dark rings in south-eastern examples of *Viverricula*, the 8th. when present being very faint.

These, however, are the only Burmese skins which, on the available evidence, can with some assurance be assigned to the Malayan race. But 30 miles north of Tonghoo, in the valley of the Sittang, Mr. Mackenzie secured three examples of which one at least, collected January 8th., is more like *klossi* than *thai* as I understand these races. The winter coat is full, close and soft, not loose as in *thai;* and the general colour is rich ochreous, the under side is also washed with ochreous; the pattern is black, obscured by rusty speckling; the tail has 9 dark rings.

The other two specimens, dated March 18 and 23, are strikingly different, the coat being coarser, thinner and shorter, the colour pallid, without brightness, buffy grey or silvery grey on the flanks, darker on the back; the pattern is black and sharply defined. These are clearly skins in dead bleached coat with the moult imminent; but the date seems to be wrong. They are very similar in coat and colour to the September and October skins from Mt. Popa and Sagaing referred to above under *thai.*

Except that this race seems to be on the average a little smaller than *thai* and has the bullæ a trifle closer together, there is very little difference between them so far as the skull is concerned.

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn
Patani, ad. ♂	3·8	1·7	·5	·6¼	19	7	8×5
Perak, ad. ♂	3·8	1·8+	·5	·7	...	...	8×5
(Malacca, *Kloss*), ad. ♂	3·8+	1·9	...	...	...	7½—	...
Pinang (type), ad. ♀	3·8	1·8	·5	·6½	20—	7	7×5
Pinang (type), subad. ?♀	3·7	1·7	·4½	·6+	19	7	8×5
(Malacca, *Kloss*), ad. ♀	3·9—	1·9	...	...	...	7—	...
Tenasserim, ad. ♂	4·1	2·0	·5	·7	20	7	8×6
Sittang delta, ad.? ?sex	3·9—	1·9	·4½	·6½	20	7	8×5
Sittang delta, ad.? ?sex	3·8½	1·8½	·4	·6½	19	7½	8×6
Tonghoo (30 M.N. of) ad.	4	1·8	5	7—	20	7	8×6

VIVERRICULA INDICA RASSE, Horsf.

Viverra rasse Horsfield, *Zool. Res. Java*, pp. 103-107; pl. 1824, p. 345, 1824.

Viverricula malaccensis rasse, Bonhote, *Ann. Mag. Nat. Hist.* (7), i, p. 121, 1898 (in part).

Locality of type: Java.

Distribution: Java, apparently restricted.

A very uniform series of 20 skins collected by G. C. Shortridge at Tassikmalaja in Preanger, 1,145 ft., between December 31 and February 1, at Batavia in July and August, at Buitenzorg, 835 ft., and on Kangean Island in November, shows no appreciable seasonal variation in coat or colouration. The general colour is olive grey, grey with a faint buff wash but no silvery tint; the pattern in all is distinct, normal and usually blackish brown, but sometimes more or less obscured by rusty ochre speckling. The tail has from 7 to 9 dark bands. The coat is short without much underwool and the long hairs are about 25 mm. irrespective of season.

Measurements of largest specimens:—

Preanger and Batavia ♂, ♂. Head and body 22 2/5 in., tail 14 in.

Preanger ♀. Head and body 21 3/5 in., tail 13 in.

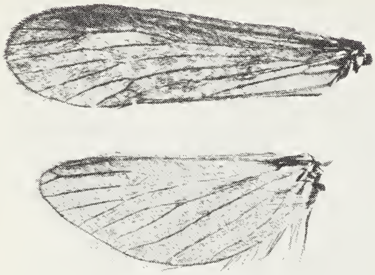
Kangean Island ♀. Head and body 21 1/5 in., tail 14 in.

These specimens agree closely with Horsfield's good description of *Viverra rasse*. The race differs from the Malayan and Indo-Chinese and Burmese forms in having the tail typically dusky above at the end and never exhibiting the long white tip of those races. The coat too is dull, not bright in hue as in *klossi* and never luxuriant as in *thai*.

Cranial measurements:—

	In English inches				In mm.		
Locality and Sex	Total length	Zygom. width	Waist width	Max. width	Bulla	Space between bullæ	Upper Carn.
'Java' (type) yg. ad.	3·7½	1·7−	6+	6+	18	8	7½×5
Batavia, ad. ♂	4·0	1·8½	·5½	·6½	19	8	8½×5
Preanger, ad. ♂	3·9½	1·8½	·5	·6½	19	8	8×5
,, ad. ♂	3·9	1·8½	·5	·6½	18	8	8×5
,, old ♂	3·8½	1·8½	·5	·7	18	8	7½×5
,, old ♀	3·9½	1·8½	·4	·7	18	7½	8−×5
,, ad. ♀	3·7	1·8	·5	·6	19	8	7×4¾
,, ad. ♀	3·6+	1·7	·4	·6	17	7	8×5
Kangean Isl. subad. ♂	3·8	1·7	·5½	·6	19	7	7½×5
,, ,, ad. ♀	3·6	1·8	·5½	·6	17	7	7½×4

In cranial measurements there is no apparent difference between the Javan and Malayan races except that in the former the bullæ are on the average a little smaller and more widely separated at the narrowest point between them. On the other hand the skull and bullæ of *rasse* are on the average a little shorter than in the Burmese, Siamese and Indo-Chinese specimens assigned to *thai*, but the distance between the bullæ as Kloss stated, is about the same in the two.



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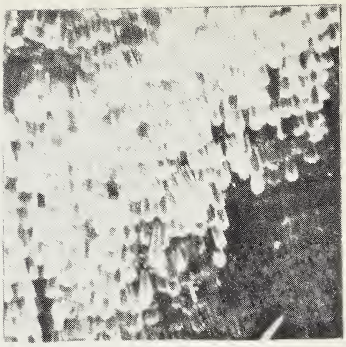

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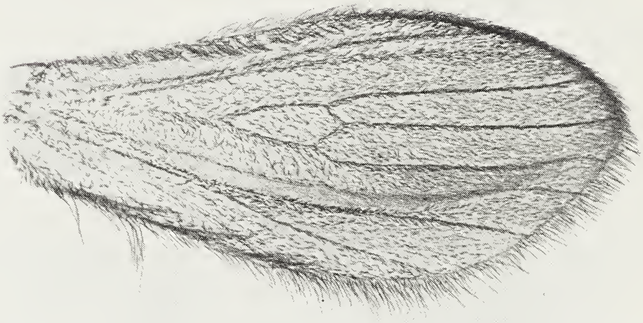

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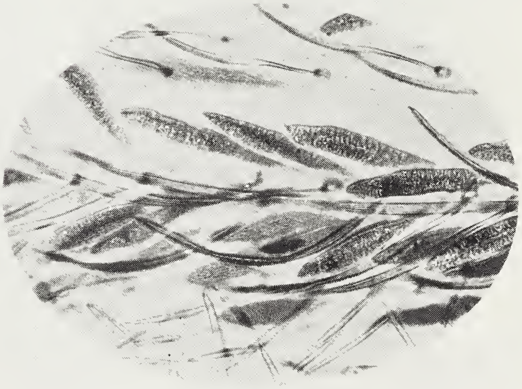

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Photo M.E.M.

TRICHOPTERA

Fig. 1. Wings of *Mystacides nigra* L. × 5.
Fig. 2. Portion of a wing of a Lepidopteron × 60.
Fig. 3. Wing of *Lepidostoma hirtum* F. × 9.
Fig. 4. Some of the scales on the wing of *L. hirtum* F. × 250.

THE INDIAN CADDIS FLIES.

LIFE HISTORY, COLLECTION AND PRESERVATION.

BY

MARTIN E. MOSELY, F.R.E.S.

PART I.

(*With three plates*).

In this, the first of a series of articles dealing with the Caddis-flies of the Indian fauna, I propose to describe what a caddis-fly is, how it lives, how it reproduces its species and the manner of its death. I shall also tell of how it may be caught, where it may be found, and how it should be preserved to the best advantage in collections.

What is a caddis-fly? This is the first point. I might explain it by stating that the caddis-flies are known to the entomologist as the *Trichoptera*. This is not a very lucid explanation, yet to those with some knowledge of the Greek tongue, it conveys a sound definition. The name *Trichoptera* is derived from two Greek words which mean 'a hair, a wing'. That is to say, the *Trichoptera* are 'hairy-winged'. Similarly, the butterflies and moths are known as the *Lepidoptera*, also derived from Greek words for 'a scale, a wing'. These insects, then, are 'scaly-winged'. It is a broad distinction, not by any means the only one between the two Orders and it generally suffices.

Be it understood that, in the insect world, the words hairs and scales have a particular significance. An insect-hair is not precisely similar to what we generally consider a hair such as the hairs on our heads or the hairs which constitute fur, nor is an insect-scale of the same substance as the scales of a fish, or a snake, or a lizard. In insects, hairs and scales are composed of the same substance and are merely a modification of each other. This substance is called *chitin* and is a kind of skin which covers, not only all the external parts of insects, varying in texture, pattern and hardness according to the uses it serves, but encloses the internal organs as well. It resists the action of both acids and alkalis and, consequently, when only external structure is required, specimens can be treated by both these reagents so that all parts not composed of *chitin* may be dissolved away; then a clear transparent residue of these external structures is left for mounting as a microscope object, a useful aid to the determination of a species.

The scales of the *Lepidoptera* are formed of flat plates with striated surfaces and, generally, jagged apical margins. These plates overlap one another like slates on a roof and are shown in fig. 2. The hairs of the caddis-fly wing in some groups form a dense mat as shown in fig. 1. In other groups they may be long and widely scattered and there is one group, represented in India, in which the wings have a white, glassy talc-like appearance with merely a few short hairs here and there along the nervures or veins. In yet another group, some of the hairs on the wings of the male insects only are modified, being much thickened. There are considerable numbers of these insects in India and therefore a whole wing is shown in fig. 3, fig. 4 being a much enlarged photograph of a few of these thickened hairs which are also termed scales. It will be noticed how different these caddis-fly scales are from those of the *Lepidoptera*. My photographs are taken from a British insect belonging to this group.

So much for hairs and scales. A very important structural difference between the caddis-fly and the moth lies in the formation of the mouth-parts. The latter has a long flexible proboscis through which it can suck the sweet juices of the flowers or any other juices that may please its fancy, not always sweet and not always derived from flowers. The caddis-fly has no such organ. In fact, its mouth-parts are so ill-developed that it is practically unable to feed at all. I say *practically*, because there are records of caddis-flies having been taken at night with moths on sugar and it may be that they are able to absorb very minute quantities of liquid through a large fleshy tongue that is a conspicuous feature of their mouths. Personally I have never found food in the alimentary canals of the many thousands of caddis-flies that I have made into microscope preparations, and I doubt whether they feed at all even though they may be attracted by the scent of the sugar solution. In any case they cannot absorb enough nourishment by this method to sustain life and all serious feeding takes place in the larval stage; life in the winged condition is very brief and only serves for the reproduction of the species.

Readers of these opening paragraphs should now be able to recognise a caddis-fly and I continue with a brief account of the life and habits of these insects.

To begin at the beginning we will consider the egg. The eggs of the caddis-fly are sometimes enveloped in a gelatinous secretion and carried as a ball at the extremity of the abdomen of the female insect as seen in fig. 5. They may be green in colour, brown or yellow. Sometimes they may be deposited one by one under some convenient rock or stone in the water at the bed of the stream or pond, the insect crawling down a weed-stem or the side of a rock, enveloped in a bubble of air, to select the desired spot. Or they may be extruded in a gelatinous mass upon some leaf or twig overhanging the stream, the young larvae dropping into the water when hatched. When carrying the eggs at the oviducts in a mass, the insect has been seen to descend beneath the surface and attach the ball of eggs to a post or a rock to which it adheres. This, perhaps, may even be the invariable practice.

Contact with the water causes the gelatinous secretion to swell as seen in fig. 6. In the course of time, which may be a few days or a few weeks or even longer, the eggs hatch and the young larva, if of a case-making group, immediately proceeds to make its case.

I will now introduce to your notice some curious little creatures with which those of you who are fishermen are probably very familiar though perhaps without realising what they are. All who have spent a few hours by the water-side, either river, pond or lake, or even ditch, must, at some time or another, have noticed under the water, little bits of sticks or even stones apparently moving about by themselves. If they have been sufficiently interested to investigate more closely the somewhat astounding phenomena, the explanation will have been forthcoming and they will have noticed a head and a few legs protruding from one end of what is really a little house or case and a live creature within which walks about on the stones or mud of the bottom, dragging its home along with it as does the snail its shell.

This is the caddis-grub or caddis-worm or just the caddis, as it is sometimes called, and it is the larva of the caddis-fly. It bears exactly the same relation to the winged insect as the caterpillar bears to the butterfly or moth and it goes through precisely similar changes before entering into the winged state though, naturally, there are slight modifications of method due to these changes taking place under water.

The cases are constructed in various patterns according to the group to which the caddis-fly belongs; sometimes they are fashioned entirely of stones, sometimes of bits of stick or weed or both. They may be decorated with empty snail-shells or even living snails, or they may be formed of grains of sand or bits of broken shell arranged so smoothly and evenly as, not only to equal, but far excel in accuracy of workmanship any tesselated pavement constructed by the hand of man. Some of these cases are shown on Pl. II. To every case there is an inner lining of a silky substance spun through the mouth of the caddis-grub and the outer covering of stones or twigs is attached to this silken tube. The larva is furnished at the tail-end with two powerful hooks with which it clings to the case and drags it along. So firmly does it attach itself with these hooks, that attempts to pull it out by the head generally result in tearing it asunder.

As it grows, it enlarges its case in front, cutting it away at the tail-end to the required size.

Travelling about the bed of the stream, it uses, of necessity, the material that lies at hand for case-construction so that, in practice, it is automatically camouflaged and always tones in with its surroundings, thus being perfectly safeguarded, when at rest, from its numerous foes.

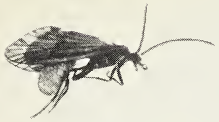
Now, some lines back I made use of the words when describing the first action of a newly-hatched larva, *if of a case-making* group. These words correctly imply that there are some groups in which the larvae do not make cases. Some make merely a loose web of silken threads attached to neighbouring weed-stems and they live in the centre of it like a spider, pouncing out and devouring any living thing that is swept by the stream or unluckily swims into its meshes. The web differs from that of the spider, lacking its symmetry; it is a confused collection of silken pockets somewhat like the pockets of a trammel fishing-net. A caddis of this group is shown in fig. 13. Another group of caddis-larvae contains caseless insects which merely wander about the bottom, keeping for safety under the stones, feeding as and when they can (fig. 14). Both groups of these free larvae, however, make cases of stones for a protection when about to pupate, but more of this anon.

We will return to our case-making caddis where we left it, namely enlarging its case to keep pace with its growth and roaming about over the bottom in constant search for food. Some feed on algae, diatoms or water-weeds, some on animal matter as well. I remember watching three or four caddis-grubs feeding busily on a big carpenter bee which had fallen into the water and, dead, was slowly circling an eddy in a Corsican stream. They do not hesitate to attack each other. The front of the case is amply protected by the horny head with its powerful jaws and by the active legs, but the tail-end is more vulnerable and the caddis is compelled to take special precautions to guard its hinder parts. It therefore constructs a door, consisting of a hard plate perforated by a single round hole as seen in fig. 12. The plate protects its rear and yet allows the water free passage, for a stream of water passing through the case is essential for the insect's breathing; attached to the abdomen there is a complicated series of filaments which, waving about in the stream, extract the air which passes into the breathing system; without a constant supply of fresh water, our caddis would promptly die and it obtains this supply, sucking it into the case, by undulating its abdomen.

The caddis does not always wander about in search of food. There is one group, of which the fly shown in fig. 5 is an example, where the larva moors its case, fore and aft, to some weed or rock and stretches its median and posterior legs out at the front waiting for what providence in the form of the stream, may bring within its reach. When any living creature touches these legs there is a snap, the legs double up and the victim is impaled on a formidable row of spikes that line the inner edges of the limbs; the pair of much abbreviated fore legs serves as hands, conveying the food to the ever-waiting mandibles. Fig. 7 shows one of these larvae removed from its case. Note the unprotected abdominal segments, the strongly developed posterior and median legs with the inner spikes just faintly indicated, and the abbreviated fore legs. It is obvious that this insect can only live in a comparatively fast stream as, in stagnant water, it would starve whilst waiting for chance visitors to swim within its reach. My photographs are of a British fly, known to trout-fishermen as the Grannom, but a near relation, having the same habits, has been discovered high up in the Kashmir Mountains.

Well, whether the caddis lives in a case or is free, in the course of time, generally ten or eleven months, it attains its full growth and then there comes a startling change. It ceases to feed and all its energies are bent to the preparation for its brief life above water. Its first concern is to provide for safety during the helpless pupal stage.

If it is a free caddis, it proceeds to make a rough case of stones, an oval mass attached to some large stone or rock, generally on the under side; certain species make a cocoon, brown and of a horny nature within the stony covering. If it is a case-making



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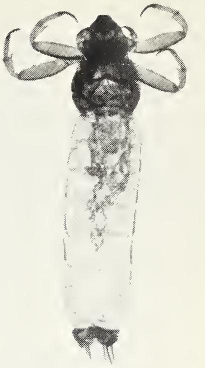

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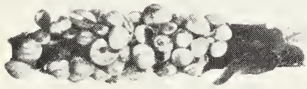

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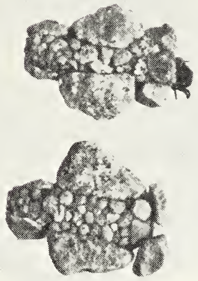

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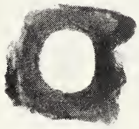

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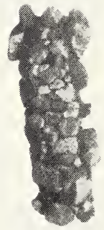

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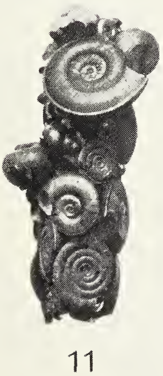

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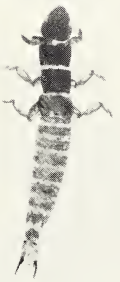

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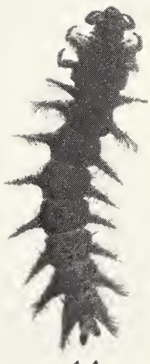

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Photo *M.E.M.*

TRICHOPTERA

Fig. 5. ***Brachycentrus subnubilus* Curt.** ♀ carrying egg sac × 1½.
Fig. 6. Egg sac after having been placed in water × 2.
Fig. 7. Larva of *B. subnubilus Curt.* removed from its case × 4½.
Fig. 8. Larval case of *Limnophilus lunatus Curt.* × 1½.
Fig. 9. ,, cases ,, *Goëra pilosa* F. × 1½.
Fig. 10. ,, ,, (unknown) × 1½.
Fig. 11. ,, ,, ,, *Limnophilus flavicornis* F. × 1½.
Fig. 12. Perforated plate guarding the tail-end of the larval case × 8.
Fig. 13. Free larva (*Hydropsyche* species) × 3.
Fig. 14. ,, from Kashmir, genus and species unknown × 1¼.

caddis, it seals both ends either by attaching to them bits of stone or water-weed, or else boldly attaching the tail-end of the case to a large stone or even to another caddis and merely securing the front door. Fig. 15 shows a group of the caddis of the Grannom which have attached their cases to one another, three or four deep, for pupation. Within these outer defences it constructs a very elaborate grating varying in its nature according to the group to which the fly belongs. Sometimes it is a horny perforated plate, sometimes a silken net. Always is it so constructed that the water may flow freely in and out. Two forms of this grating are shown in figs. 16 and 17.

Then there comes a resting stage and slowly and gradually the adult fly is built up within the pupal envelope. As occurs with the caterpillar, the larval skin is shed and pushed down to the tail-end of the case which takes the place of the caterpillar's cocoon.

The pupa of the caddis-fly differs in some respects from that of the caterpillar. It has to work hard before the fly can emerge into the air and, to this end, it has to be specially prepared. There is the stony case, sealed at each end, in which it is imprisoned and from which escape must be made. Then there may be several feet of water through which it will have to swim. These actions have to be performed by the pupa and it has accordingly to be fitted with a technical equipment to enable it to fulfil its destiny. If we examine a pupa, we shall find that nothing has been overlooked. The various parts are not locked away together in a horny case as occurs in the chrysalis of the moth but each limb is contained in its own separate covering and is available for use when required. We see a pair of powerful mandibles for cutting a passage through the sealed front-door; also rows of strong hooks which are mostly directed downwards to aid the pupa in wriggling up and out of its case (fig. 20). Paddles are provided in the form of fringed legs to enable the pupa to swim through the water (fig. 21). Everything is there that the pupa can possibly require.

All those highly specialised organs are used solely in the transition from the case under the water to the air. Afterwards they no longer have a value and are consequently left behind with the pupal skin. A wonderful set of tools evolved through the long ages, used but once, perhaps only for a few minutes and then discarded! Pupae belonging to two different groups are shown in figs. 18 and 19.

In some groups, as the pupa reaches the surface, the fly emerges from the pupal skin and flutters to shelter in the sedges and rushes that fringe the banks. In others, the pupa climbs out of the water and fixes its claws in the crevices of a rock or to some weed-stem and there may be a considerable interval before the fly emerges. In both cases there is no gradual development or swelling of the wings as in the *Lepidoptera*. The wings have been folded within the pupal wing-cases and are withdrawn full size. They have only to harden and even before they have hardened, in fact immediately on their withdrawal, they are available for short, fluttering flights.

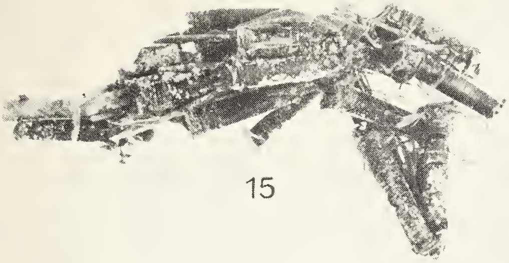
A day or two is spent amongst the sedges with periods of flight generally towards evening or at night but sometimes in full sunlight and then copulation takes place in the shelter of the rushes and the final act approaches.

When the female is ready to lay its eggs, as was explained at the beginning of this article, it often descends beneath the surface of the water and fixes them in some suitable spot. Then, having taken all precautions to safeguard the race, it allows the current to sweep it from its hold and so it dies.

One might imagine that a creature such as the caddis-grub, living as it does beneath the surface of the water, would be immune from the attentions of Ichneumon flies. This is not the case. At least one species of Ichneumon has been observed to descend into the water and, enveloped in a film of air, run about quite easily over the stones of the stream-bed in search of the particular caddis that is to serve as the involuntary host to its children. Not every caddis will serve. The Ichneumon requires a species which weights its case with heavy stones as shown in fig. 9, and the grub within must either have pupated or else be about to pupate. Having found a suitable host, our Ichneumon forces its ovipositor between the outer stones of the case and lays an egg on the grub within.

In the course of time, the egg hatches and the young larva devours its host and itself undergoes its transformation to the adult fly. This fly hibernates in the case of the host, enveloped in a large air-bubble collected in some not well-understood manner by the larva before pupation, and it emerges in the following spring. The necessity for the heavy weighted case now becomes apparent. Without the heavy stones the bubble of air within would cause the case to rise to the surface and it would be carried away by the stream.

I have now arrived at the second part of my subject and it remains for me to describe how the flies may be caught and how preserved. I would like to preface these instructions by a few remarks on *why* they should be caught and preserved. Collecting is a fascinating hobby, indulged in by nearly every boy in every land and it forms a useful and attractive ground-work for future entomological researches. Unfortunately only too often the hobby ends where it began. Everywhere, throughout every country, there are partial collections of *Lepidoptera* crumbling away in boxes and cabinets and nearly always, a mere repetition of collections made by previous generations. Here in England, the British Museum is encumbered with these collections which have little or no value to science. On the other hand, were the energies that have gone to waste directed into other entomological channels, a great advance could be made in many Orders where scientific knowledge is in its infancy. One of these Orders where information is much wanted is the *Trichoptera* or the caddis-flies. India is a big country with every condition required for the development of these insects. There are the big rivers and the hill streams. The snow-clad mountains with their countless spring-fed rivulets are the natural habitats of many diverse genera and, in India, the Order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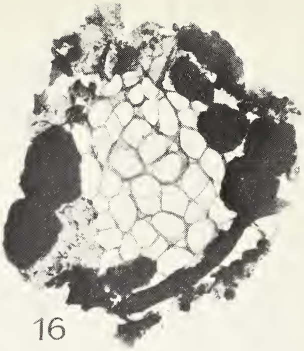
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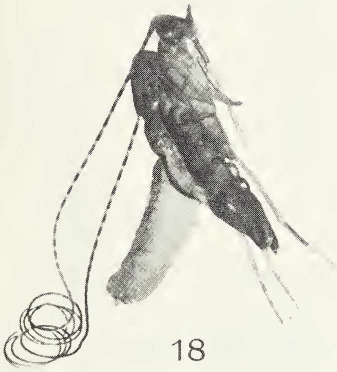
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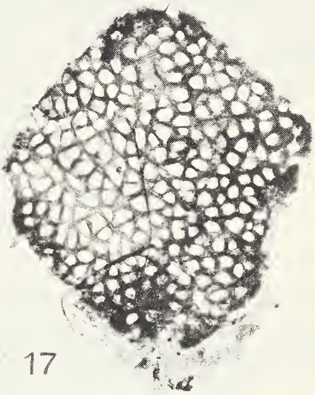
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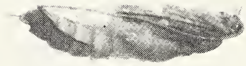
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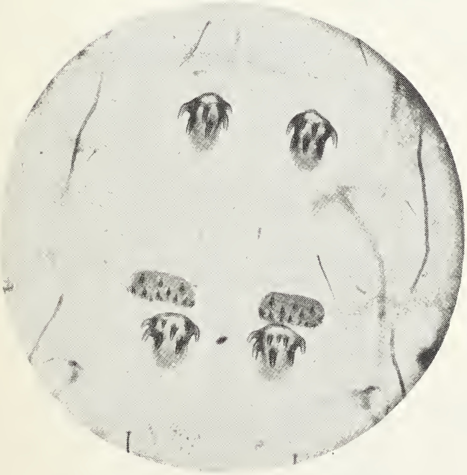
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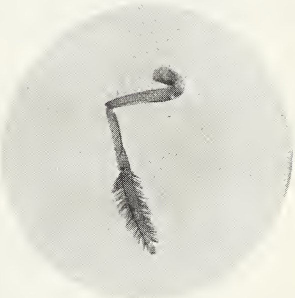
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Photo M.E M.

TRICHOPTERA

Fig. 15. *Brachycentrus subnubilus Curt.* pupal cases × 1½.
Fig. 16. Pupal grating, *Limnophilus marmoratus Curt.* × 9.
Fig. 17. ,, ,, Kashmir species, (unknown) × 9.
Fig. 18. Pupa of *Leptocerus albifrons L.* × 6.
Fig. 19. Pupa of *L. marmoratus Curt.* × 2.
Fig. 20. Dorsal hooks on pupal exuvium of *Micropterna sequax* McL. × 18
Fig. 21. Median leg of pupa of *Phryganea varia* F. × 1½.

is practically untouched. Here is a field for original research which should arouse the enthusiasm of almost every collector who has at heart the desire to forward the progress of science.

It is with a view to encouraging this work that I am writing these articles in an Indian journal. I would appeal particularly to my fellow trout-fishermen to make collections. Caddis-flies are of much importance as food for trout and moreover, many of the artificial patterns owe their origin to these insects. Throughout the British Empire, fly-fishers come in contact with these water-insects and entomology owes much to their efforts.

The Trichoptera of New Zealand and South Africa were practically unknown until the trout invaded their waters and now, our knowledge of the water-insects of these countries may be said to be chiefly due to the enthusiasm of the fly-fisherman.

There is a large field for scientific work in India in connection with fishing and I feel sure Indian trout-fishers will lend a hand.

The equipment required for the collection of caddis-flies is the same as that used for the collection of Lepidoptera though a slight modification of the net may be of advantage. I myself prefer to have my nets with white bags rather than green or black. It is easier to spot the insects within them. The best material I have found for these bags is known as *book-map muslin.* It is a very close fabric and very strong. The ordinary butterfly-net material allows the smaller caddis-flies to escape through the meshes. Lightness in the frame should be sacrificed to strength, as caddis-flies, during the day-time, are mainly taken by beating and a very light frame soon gives out.

Many species are attracted to light and full advantage should be taken of this instinct. The ordinary killing-bottles may be used, preferably laurel, which acts both as a killing and relaxing agent.

The next point is 'where to collect'. Almost any permanent water-course, where the water does not become unduly warm, should produce some form of caddis-fly though the Order is more largely represented in the cold mountain-streams. The snow-clad Himalayas are ideal hunting-grounds but actual glacier-streams are barren and should be avoided. Where there is everlasting snow there are abounding springs and spring-fed torrents and these produce caddis-flies in quantity. Lakes and ponds all provide their quota and the wayside drainage ditches are sometimes full of varied forms. Springs oozing through the herbage, water trickling down a rocky wall, cascades, anywhere in fact where there is permanent water, generally reward the seeker.

The best method of collecting is to sweep the vegetation by the water-side or to tap the net under overhanging branches. Sometimes I carry a stout stick to beat out possible hiding-places too well guarded by thorns for the net to be brought into direct contact. Insects can be caught as they fly out.

The short herbage, wet with spray, bordering water-falls, should not be neglected and often harbours distinctive species. At high altitudes many caddis-flies may be found sheltering from the keen winds on the undersides of rocks and stones.

It is unfortunately of little use to collect larval forms. Until the knowledge of the adults is far more advanced, it will not often be possible to determine their identity and to associate them correctly with the adult flies.

We now come to my last heading 'How should the caddis-fly be preserved?' The ideal is a duplicate method, half the material pinned and set, half in fluid. Whenever it is possible, captures should be set fresh. These insects are difficult to relax and seldom make good cabinet specimens when relaxing has been necessary. Nevertheless unset material is always preferable to no material at all, and specimens can be broken up and their parts examined separately if there should be any doubt as to their identity.

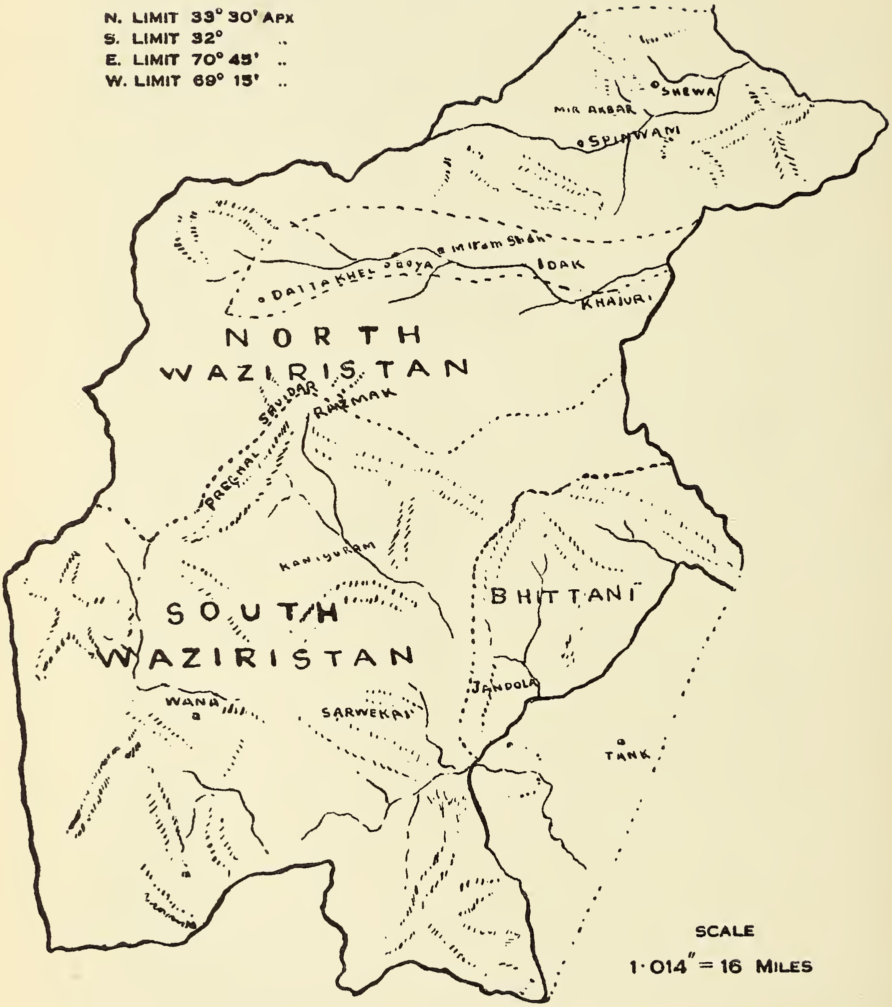
The best collecting fluid is a mixture of 1 part of 90 per cent alcohol to 2 parts of 2 per cent formalin. A 2 per cent solution of formalin is made by taking 1 part of commercial formalin, which is a 40 per cent solution of formic aldehyde, and diluting it with 19 parts of water.

On the return home it is advisable to transfer captures from the collecting fluid and store them in 2 per cent formalin solution without any alcohol. 2 per cent formalin alone is too dense a medium for direct collecting as it will not readily penetrate the tissues, hence the preliminary use of the collecting mixture. Pinned specimens will of course be preserved in cabinets or boxes.

In connection with these articles, assistance is cordially invited with a view to obtaining as full a record as possible of the Indian caddis-flies and collections may be sent to the Bombay Natural History Society, who will arrange for the determination of the species and their record.

My next article will deal with the classification of the Order.

(To be continued).


N. LIMIT 33° 30' APX
S. LIMIT 32° ..
E. LIMIT 70° 45' ..
W. LIMIT 69° 15' ..
SHEWA
MIR AKBAR
SPINWAM
Miram Shah
BOYA
DATTA KHEL
IDAK
KHAJURI
NORTH WAZIRISTAN
SHUIDAR
RAZMAK
PREGHAL
KANIGURAM
SOUTH WAZIRISTAN
BHITTANI
JANDOLA
WANA
SARWEKAI
TANK
SCALE
1·014" = 16 MILES

MAP OF WAZIRISTAN.

THE FLORA OF WAZIRISTAN.

BY

E. Blatter, S.J., Ph.D., F.L.S. and J. Fernandez.

Part I.

(*With 1 map and 1 plate*).

1. History of the Botanical Exploration of Waziristan.

It can be told in a few words. In 1860 John Lindsay Stewart,[1] M.D., Assistant-Surgeon, accompanied the First Mahsood Expedition. The force had assembled near the city of Tank. They left this place on the 17th April and advanced up the Tank Zam as far as Palosina Kats. Here the force divided, two thirds proceeding up the Shaur valley and the remainder going into standing camp at Palosina. Amongst the latter was Stewart. After the forces had joined again they proceeded viâ the Pass Anai, the Barrara Pass, Barapita, Bungiwala, Kaniguram, Barpit, Doboi, Makin, Tandachina, Razmak, Dirdoni, Razani, Siroba, Dwa Warkha and arrived finally at Bannu on the 20th May 1860.

In all rather more than 400 species of plants were collected between Tank and Bannu, 'about 70 of these being wood-climbers, shrubs, or sub-herbaceous, the rest herbaceous'.

Stewart gives a short but interesting sketch of his botanical results in vol. xxxii (1862) of the *Geographical Journal*, pp. 316-334 under the title: 'Notes on the Flora of the Country passed through by the Expeditionary Force under Brigadier-General Chamberlain, against the Mahsood Wuzeeris; April 17th to May 19th, 1860.'

In 1888 and later on in 1891 a considerable collection of plants was made in Tank and S. Waziristan by Rev. Dr. J. Williams. His plants are preserved in the Herbarium at Dehra Dun.

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[1] Stewart was born about 1832 at Fettercairn, Kincardineshire. He was in India from 1856-69 and returned there in 1872 and died at Dalhousie on the 5th July 1873. The plants he collected in many places are at Kew and Edinburgh. His chief publications are:—

Forests and Fuel Plantations of the Panjab. Lahore, 1868.

Panjab Plants. Lahore, 1869.

Memorandum on the Peshawar Valley and its Florâ. *Journ. As. Soc. Beng.*, 1863.

The Sub-Sewalik Tract with special reference to the Bijnour Forest and its trees. *Journ. Ag. Hort. Soc. Ind.* xiii, 1865.

Journal of a Botanising Tour in Hazara and Kaghan. *Journ. Ag. Hort. Soc. Ind.* xiv, 1866.

Tour in the Panjab Salt Range. *Journ. Ag. Hort. Soc. Ind.* i (new series) 1867.

Notes of a Bot. Tour in Ladak and W. Tibet. *Trans. Bot. Soc. Edinb.* x, 1869.

The Forest Flora of North-West and Central India, commenced by J. L. Stewart, continued and completed by D. Brandis. London, 1874.

In 1895 J. F. Duthie sent his collector to Waziristan, who gathered, chiefly in S. Waziristan, over 200 specimens. One set is being kept at Kew, and another at Dehra Dun.

In 1927 the Resident of Waziristan asked for a collector to gather Natural History specimens in that country. Fr. Blatter was asked on the point and he recommended his friend Joseph Fernandez who had just returned from Oman, where he had been attached as collector to the D'Arcy Exploration Party under Mr. Lees. When arriving in Waziristan Fernandez was given a map with the following places marked out for examination: Datta Khel, Miram Shah, Razani, Razmak, Sararogha, Jandola, Sarwekai and, if there should be time, Tank. The whole tour had to be done in 3 months. Fernandez arrived in Waziristan on the 22nd March 1927 and left it on the 30th June. Considering the short time it is amazing that he brought home an extensive collection of about 9,000 plants in addition to a considerable number of animal specimens. The plants are at present in Fr. Blatter's herbarium.

In September 1927, Capt. W. R. Hay, then Political Agent of S. Waziristan, made an ascent of the highest mountain in Waziristan, viz. Pre Ghal. He described the journey under the title 'Pre Ghal in Waziristan' in the *Geographical Journal*, vol. lxxii (1928) 305-324. A small but interesting collection of plants was named at the Botanical Department of the British Museum.

At the invitation of Mr. A. D. F. Dundas, at the time Political Agent of N. Waziristan, and Capt. J. A. Robinson of the 13th Frontier Force Rifles, Fr. Blatter undertook, in company of Fr. F. Palacios, Professor of Zoology at St. Xavier's College, Bombay, and Mr. J. Fernandez, an extensive exploration tour in Waziristan. They spent a little less than 3 months in that country, supplementing the collection made by Mr. Fernandez 3 years previous by about 3,000 botanical specimens.

2. Area dealt with.

In addition to N. and S. Waziristan we include in the area of our Flora part of Tank, a subdivision of Dera Ismail Khan. Practically speaking only plants growing at Tank and in its neighbourhood and between Tank and Waziristan in a north-westerly direction are thus considered. We do this because Stewart, Williams and Duthie's collector started their exploring expeditions in that area. The localities given for the various species are therefore grouped under three headings: N. Waziristan, S. Waziristan and Tank.

We shall deal with the meteorology and ecology at the end of the list of plants.

Up to now we have published the following papers on the vegetation of Waziristan:

H. N. Dixon: Mosses collected in Waziristan by Mr. J. Fernandez in 1927. *Journ. Bomb. Nat. Hist. Soc.*, xxxiii (1929) 279-283.

E. Blatter: Plantae Novae Waziristanenses. Collectae a Josepho Fernandez et descriptae ab E. Blatter. *Journ. Ind. Bot. Soc.* ix (1930) 199-207.

E. Blatter and *J. Fernandez*: Waziristan Mosses, with some new species described by H. N. Dixon. *Journ. Ind. Bot. Soc.* x (1931) 145-153.

E. Blatter: A new Gentian from N. Waziristan. *Journ. Bomb. Nat. Hist. Soc.* xxxv (1932) 861.

E. Blatter: New plants from Waziristan. *Journ. Bomb. Nat. Hist. Soc.* xxxvi (1933) 477-484.

The following abbreviations have been used:

N.W. = Northern Waziristan.
S.W. = Southern Waziristan.
B. = Blatter.
F. = Fernandez.

DICOTYLEDONEAE.

RANUNCULACEAE.

700 species.—Chiefly N. temperate regions.

Clematis L.

220 species.—Cosmopolitan.

Clematis montana Ham. ex DC. Syst. i (1818) 164.
Locality: *S.W.*: In the upper regions (Stewart).
Distribution: Himalaya from the Indus eastwards, 7,000-9,000 ft., Khasia Hills, 12,000 ft.

***Clematis montana** Ham. **var. rubens** Wilson.
Locality: *S.W.*: Razmak, planted in garden (B. & F. !).

Clematis barbellata Edgew. in Trans. Linn. Soc. xx (1846) 25.
Vernacular name: Periae, Parvateae (Waziri).
Locality: *N.W.*: Razani, 5,000 ft., along raised wall round fields (F. 2826 ! 3008 !).
S.W.: Razmak, 6,500 ft. (F. 1819 ! 1822 ! 1827 ! 1967 ! 1968 ! 2462 ! 2465 ! 3055 ! 3234 ! 3240 !).—Pre Ghal (Duthie's Collect. 15794 !).—E. of Razmak, on grassy slope (B. & F. 1955 !).—N. of Razmak, on way to Springs, 6,700-7,300 ft. (B. & F. 1763 !).—W. of Razmak, stony plain, 6,800 ft. (B. & F. 1719 !).
Flowers: 7-5-1895 (Pre Ghal).
Distribution: W. temperate Himalaya from the Ravi eastwards, 5,000-12,000 ft.

Clematis grata Wall. Cat. (1828) no. 4668.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 1904 !); below Springs, 7,700 ft. (B. & F. 1831 !).—E. of Razmak, on grassy slope (B. & F. 1956 !).—Near Kaniguram, about 6,500 ft. (Stewart).
Distribution: Kuram Valley, N.-W. Himalaya, 2,000-8,000 ft., Upper Burma, China.

Clematis graveolens Lindl. in Journ. Hort. Soc. i (1846) 307.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 1842 ! 1886 ! 1889 ! 1910 ! 1935 ! 3082 !).—Kaniguram (Duthie's Collect. 15753 !).
Flowers: 14-5-1895 (Kaniguram).
Distribution: Kuram Valley, Baluchistan, W. temperate Himalaya to Kumaon, 6,000-11,000 ft.

Clematis graveolens var. Aitkisoni O. Kuntze.
Locality: *S.W.*: Pre Ghal (Herb. Dehra Dun 7763 !).
Fruit: 3-8-1888 (Pre Ghal).

Clematis orientalis L. Sp. Pl. (1753) 543.
Vernacular name: Parvateae.
Locality: *S.W.*: On way to Springs N. of Razmak, 6,750-7,300 ft. (B. & F. 1789 !).
Flowers: 25-4-30 (Razmak).
Distribution: Dry inner valleys of the Himalaya from the Indus eastwards up to 14,000 ft., temperate Asia, from Persia to Manchuria.

Clematis connata DC. Prodr. i (1824) 4.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 1826 !).—N. of Razmak, below Springs, 7,700 ft. (B. & F. 1863 !).
Fruit: 25-4-30 (Razmak).
Distribution: Himalaya, 4,000-10,000 ft., from Kashmir eastwards.

Clematis sp.
Locality: *S.W.*: About Kaniguram (Stewart).

ANEMONE L.

120 species.—Cosmopolitan.

Anemone biflora DC. Syst. i, 201; Boiss. Fl. Or. i (1867) 12.
Vernacular name: Makhai (Waziri).
Locality: *S.W.*: Razmak, 6,500 ft. (F. 1567 ! 1581 ! 1582 ! 1589 !).
Flowers: May 1927.
Distribution: Afghanistan, Kuram Valley, Baluchistan, Kashmir, Turkestan and east to Persia.

THALICTRUM Tourn. ex L.

85 species.—N. temperate regions.

Thalictrum pauciflorum Royle Ill. 5; Hook. f. & Th. in Fl. Brit. Ind. i (1872) 11.
Locality: S.W.: Pre Ghal (Hay).
Distribution: W. temperate Himalaya, from Kashmir to Kumaon, 7,000-13,000 ft.

Thalictrum minus L. Sp. Pl. (1753) 546, **var. glandulosum** Koch.—*T. vaginatum* Royle Ill. 52.
Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15598 !).—E. of Razmak, on hillside, 6,800 ft. (B. & F. 1900 ! 1901 !).
Flowers: 17-5-1895.
Distribution: Europe, Tibet.

Thalictrum minus L. **var. majus** Hook. f. & Th. in Hook. f. Fl. Brit. Ind. i (1872) 14.—*T. majus* Jacq. Fl. Austr. v, 9, t. 430.—*T. kemense* Fries Fl. Hall. i, 94.—*T. Maxwellii* Royle Ill. 52.
Locality: *S.W.*: Pre Ghal (Herb. Dehra Dun 7764 !).—N. of Razmak, below Springs, 7,700 ft. (B.& F. 1827 ! 1828 !); on stony ground, 6,300 ft. (F. 1815 !).
Fruit: 9-8-1888.
Distribution: N.W. Himalaya.

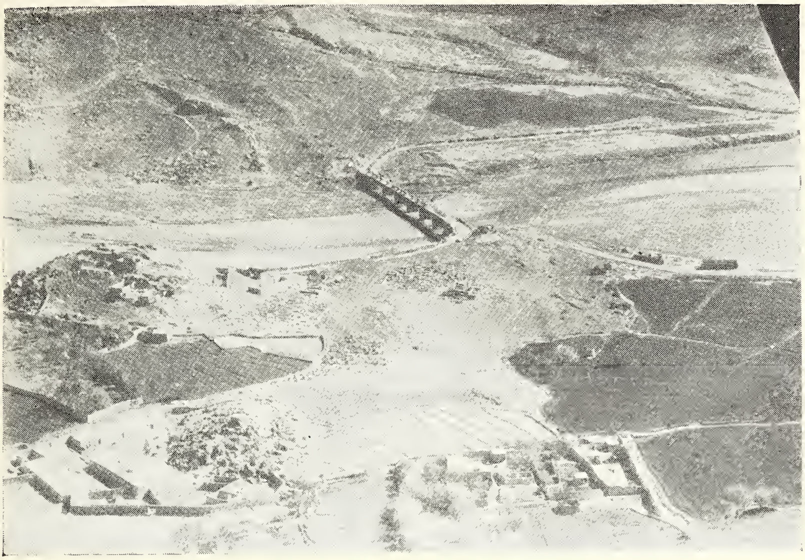
Thalictrum sp.
Locality: *S.W.*: Upper regions (Stewart).

CALLIANTHEMUM C. A. MEYER.

5 species.—Mountains of Europe and Central Asia.

Callianthemum cachemirianum Camb. in Jacq. Voy. Bot. 5, t. 3.
Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15795 !).
Flowers & Fruit: 19-5-1895.
Distribution: Inner ranges of the Himalayas, 9,000-13,000 ft., from Kashmir to Sikkim.

FLORA OF WAZIRISTAN.



1. Khajuri Bridge across Tochi River.

2. An aerial view taken in the neighbourhood of Razmak.

ADONIS Dill. ex L.

10 species.—N. palaeotemperate regions.

Adonis aestivalis L. Sp. Pl. ed. ii, 771 ; Hook. f. Fl. Brit. Ind. i (1872) 15.
Vernacular name: Chadangul, Lavang (Waziri).
Locality: *N.W.*: Razani, in fields, 5,000 ft. (F. 2222 ! 2765 ! 2933 !).—Near Datta Khel village, 4,600 ft. (B. & F. 1425 ! 1432 !).—Khunai River near Dossali, 5,000 ft. (B. & F. 1117 !).—Boya, in cultivated fields and along canals, 4,000 ft. (F. 998 ! 1097 ! 1138 ! 1171 ! 1177 !).
S.W.: (Duthie's Collect. 15659 ! 15745 !).—Slopes of Shuidar, 7,000-9,000 ft. (B. & F. 1563 !).—W. of Razmak, stony plain, 6,800 ft. (B. & F. 1700 !).—N. of Razmak, 6,700-7,300 ft. (B. & F. 1764 !).—Jandola, 2,270 ft., on open stony ground (F. 631 !).—Sararogha, 4,000 ft., on stony plain (F. 136 !).
Tank (J. Williams 9133 !).
Flowers: March; April; 12-4-30 (Dossali); 17-4-30 (Datta Khel); 18-4-30 (Shuidar); 20-4-30 (Razmak); 15-5-1888.
Fruit: March; April; 17-4-30 (Datta Khel); 18-4-30 (Shuidar); May.
Distribution: Afghanistan, Kuram Valley, Baluchistan, W. Himalaya from Peshawar to Hazara, Kashmir and Kumaon, temperate Europe and Asia.

Adonis aestivalis L. **var. squarrosa** Boiss. Fl. Or. i, 18.—*A. squarrosa* Stev. in Bull. Mosq. ii (1848) 272.
Vernacular name: Sravzah (Waziri).
Locality: *N.W.*: In a side valley of Khunai River below Razani, 5,100 ft. (B. & F. 1109a !).
Flowers & Fruit: 12-4-30 (Razani).
Distribution: Of type.

RANUNCULUS (Tourn.) L.

300 species.—Cosmopolitan, especially N. temperate regions.

Ranunculus aquatilis L. **var. trichophyllus** Hook. f. & Th. in Hook. f. & Th. Fl. Brit. Ind. i (1872) 16.
Locality: *N.W.*: Miram Shah, in ponds and ditches (F. 331 ! 876 !).
S.W.: Wana Plain, in marsh (F. 3512 !).
Flowers & Fruit: April 1927.
Distribution: Temperate N. & S. hemispheres, Afghanistan, E. & W. Tibet, Kuram Valley, Baluchistan, Punjab, Kashmir to Kumaon.

Ranunculus falcatus L. Sp. Pl. 556.
Locality: *N.W.*: On hills skirting the right bank of Khunai River, 2 miles above Dossali Fort, 5,100 ft. (B. & F. 1119 ! 1119a !).—4 miles below Datta Khel, on gravel in shade of trees, 4,550 ft. (B. & F. 592a ! 598a !).
S.W.: Between Makin and Razmak (Stewart).
Flowers: May.
Flowers & Fruit: 30-3-30 (Datta Khel); 12-4-30 (near Dossali).
Distribution: S.-E. Europe, W. Asia, Afghanistan, Kuram Valley, Baluchistan, Punjab, Kashmir.

Ranunculus pulchellus C. A. Mey. in Led. Fl. Alt. ii, 333.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 2350 !).
Distribution: Afghanistan, W. alpine Himalaya, Kashmir to Sikkim, Siberia, Mongolia.

Ranunculus hirtellus Royle Ill. 53; Hook. f. Fl. Brit. Ind. i (1872) 18.
Locality: *N.W.*: Razani, 5,000 ft. (F. 2746 ! 2757 !).
S.W.: Pre Ghal (Duthie's Collect. 15606 !).
Flowers & Fruit: 17-5-1895.
Distribution: Temperate and subalpine W. Himalaya, up to 14,000 ft.

Ranunculus sceleratus L. Sp. Pl. 551; Hook. f. & Th. in Hook. f. Fl. Brit. Ind. i (1872) 19.
Locality: *N.W.*: In the lower regions (Stewart).
S.W.: Wana, 4,500 ft. (Duthie's Collect. 15676 !).

Flowers: 7-5-1895 (Wana).
Distribution: N. temperate zone, Punjab and Bengal valleys, valleys of the Himalaya up to 5,000 ft.

Ranunculus diffusus DC. Prodr. i, 38; Hook. f. in Fl. Brit. Ind. i (1872) 19.—*R. subpinnatus* W. & A. Prodr. 4; Wight Ic. t. 49.
Locality: *S.W.*: Razmak, about 6,000 ft. (F. 1944 ! 2806 ! 2808 !).
Distribution: Temperate Himalaya from Kashmir to Bhutan, 6,000-10,000 ft., W. Peninsula, Sumatra, Java.

Ranunculus laetus Wall. Cat. 4702; Hook. f. Fl. Brit. Ind. i (1872) 19; Aitchis. Fl. Kuram Valley (1880) 30.
Locality: *N.W.*: Razani, 5,000 ft. (F. 2913 !).
S.W.: Sararogha (F. 40 ! 46 ! 52 ! 57 ! 61 ! 74 ! 79 ! 82 ! 93 ! 100 ! 109 !).—Kaniguram, 6,500 ft. (Duthie's Collect. 15746 !).—Razmak, 6,500 ft. (F. 1722 ! 1726 ! 1741 ! 1744 ! 1796 !).—Pre Ghal (Herb. Dehra Dun 7765 !).—Barrarra Pass, in wet places (Stewart).
Flowers & Fruit: May 1927; 14-5-1895.
Fruit: 9-8-1888 (Pre Ghal).
Distribution: Afghanistan, Kuram Valley, temperate Himalaya and W. Tibet, inner ranges of Sikkim.

Ranunculus muricatus L. Sp. Pl. 555.
Locality: *N.W.*: Datta Khel, along irrigation channel in garden, 4,600 ft. (B. & F. 1392 !).—Bed of Chasmai River, in clay in water (B. & F. 219 ! 243 !).—Miram Shah, cultivated fields (F. 367 ! 368 !).
Flowers: 23-3-30 (Chasmai River); 17-4-30 (Datta Khel).
Fruit: 23-3-30 (Chasmai River); 14-4-27 (Miram Shah); 17-4-30 (Datta Khel).
Distribution: Europe, W. Asia, Punjab, N. America.

Ranunculus arvensis L. Sp. Pl. 555; Hook. f. in Fl. Brit. Ind. i (1872) 20.
Vernacular name: Peri makhlak (Waziri), Kanjarvaliai (at Boya), Sarsundan (Waziri), Zirgulac (at Miram Shah).
Locality: *N.W.*: Datta Khel (F. 1200 ! 1207 ! 1251 ! 1252 ! 1305 ! 1311 !).—Boya (F. 563 ! 576 ! 1003 ! 1006 ! 1019 ! 1028 ! 1031 ! 1032 ! 1044 ! 1161 !); along canal (F. 1140 !).—Razani (F. 2819 ! 2829 ! 2830 ! 2892 ! 2911 ! 2918 ! 2945 ! 4456 !).—Miram Shah, in fields (F. 368 ! 869 !).—Shakai, 6,700 ft. (Duthie's Collect. 15644 !).
S.W.: Sararogha (F. 34 !).—Kaniguram, 6,500 ft. (Duthie's Collect. 15754 !).
Flowers: March; April; May.
Fruit: March, April, 30-4-1895 (Shakai); May; 14-5-1895 (Kaniguram).
Distribution: Europe, N. Africa, temperate Asia, N.-W. Afghanistan, Baluchistan, Kashmir to Kumaon, Mt. Abu, W. Siberia.

Ranunculus Fernandezii Blatter in Journ. Ind. Bot. Soc. ix (1930) 199.
Locality: *S.W.*: Sararogha along Tank River (F. 21 ! 33 ! 35 !).

Ranunculus echinatissimus Blatter in Journ. Ind. Bot. Soc. ix (1930) 200.
Vernacular name: Zadavankiae (Waziri).
Locality: *N.W.*: Razani (F. 2912 ! type); Boya (F. 563 !).—Near Shewa Post, right bank of Kuram River (B. & F. 919 !).—Right bank of Chasmai River, sandy clay, 3,100 ft. (B. & F. 324 !).—Datta Khel, garden along irrigation channel, 4,600 ft. (B. & F. 1392 ! 1429 !).
S.W.: N. of Razmak, below Springs, 7,700 ft. (B. & F. 1802 !).
Flowers & Fruit: 24-3-30 (Chasmai River); April 1927 (Razani); 5-4-30 (Shewa Post); 8-4-27 (Boya); 17-4-30 (Datta Khel); 25-4-30 (Razmak).

Ranunculus dasycarpus Boiss. Fl. Or. i, 28.
Locality: *S.W.*: Slopes of Shuidar, 7,000-9,000 ft. (B. & F. 1594 !); W. of Razmak, stony plain, 6,800 ft. (B. & F. 1699 !).
Fruit: 18-4-30 (Shuidar); 24-4-30 (Razmak).

Ranunculus nanus Blatter in Journ. Ind. Bot. Soc. ix (1930) 199.
Locality: *N.W.*: Razani (F. 2934 !).
Flowers: April 1927.

AQUILEGIA (Tourn.) L.

75 species.—N. temperate regions.

Aquilegia vulgaris L. Sp. Pl. 533.
Locality: *S.W.*: S. of Razmak (Stewart).—Razmak, planted (B. & F. 1927a !).
Distribution: Temperate Europe and Asia.

Aquilegia olympica Boiss. Fl. Or. i, 71.—*A. vulgaris var. caucasica* Ledeb. Fl. Ross. i, 56.
Locality: *S.W.*: Sur Dar Hills (Dundas !).
Flowers: 27-6-30 (Sur Dar Hills).
Distribution: Persia, Caucasus, alpine and temperate W. Himalaya, 10,000-14,000 ft.

Aquilegia viscosa Gouan Fl. Monsp. 267.
Locality: *S.W.*: Pre Ghal (Hay).
Distribution: Armenia, W. Tibet, *alibi?*

CIMICIFUGA L.

12 species.—N. temperate regions.

Cimicifuga sp.
Locality: *S.W.*: Pre Ghal (Hay).

DELPHINIUM Tourn. ex L.

150 species.—N. temperate regions.

Delphinium uncinatum Hook. f. & Th. in Fl. Brit. Ind. i (1872) 24.
Locality: *N.W.*: Khaisora (Stewart).
Distribution: Kuram Valley, Baluchistan, Salt Range, W. Himalaya.

Delphinium saniculaefolium Boiss. Fl. Or. i (1867) 91.
Locality: *Tank* (J. Williams !).
Distribution: W. Punjab, from the Indus to the Jhelum, Afghanistan.

Delphinium Stocksianum Boiss. Diagn. ser. ii, 1, p. 12; Fl. Or. i (1867) 77.
Rostrum, calyx necnon pedicellus pilosa. Filamenta basi multum dilatata, in parte dilatata superiore ciliata.
Locality: *N.W.*: Razani, 5,000 ft., in stony plain (F. 2190 !).
Flowers: April.
Distribution: Afghanistan, Baluchistan.

Delphinium sp.
Locality: Waziristan (Duthie's Collect. 15673).

ACONITUM Tourn. ex L.

110 species.—N. temperate regions.

Aconitum laeve Royle Ill. Himal. (1834) 45, 56; Stapf Aconites of India in Ann. Roy. Bot. Gard. Calcutta x (1905) 136, pl. 92.—*A. Lycoctonum* Hook. f. & Th. Fl. Ind. i, 55; Hook. f. Fl. Brit. Ind. i, 28.
Vernacular name: Kasturae (Waziri).
Locality: *S.W.*: Razmak, along stream, 6,500 ft. (F. 1629 ! 1747 ! 1752 ! 1753 ! 1754 !).
Distribution: Himalaya, from Chitral to Kumaon, 5,000-12,000 ft.

Aconitum ? moschatum Stapf in Ann. Roy. Bot. Gard. Calcutta x (1905) 139.
Vernacular name: Malava-gru (Waziri).
Locality: *N.W.*: Miram Shah, 3,150 ft. (F. 399 !).
Distribution: Kashmir.

Aconitum violaceum Jacquem. Mss. Herb. Kew; Stapf in Ann. Roy. Bot. Gard. Calcutta x (1905) 144.
Locality: *S.W.*: E. of Razmak, 6,800 ft. (B. & F. 1888 !).—N. of Razmak, below Springs, 7,700 ft. (B. & F. 1849 !).—Razmak (F. 1854 !).

In bud: 25-4-30, 6-5-27 (Razmak); 25-4-30 (Razmak, Springs).
Distribution: Alpine zone of Himalaya, from Gilgit to Kumaon, 10,000-15,000 ft.

Aconitum chasmanthum Stapf ex Holmes Mus. Rep. Pharm. Soc. Great Brit. (1903) 2.—*A. Napellus var. spicatum* Duthie in Rec. Bot. Surv. Ind. i, no. 3, 37.—*A. Napellus* Stewart Panjab Pl. 2 (*partim necnon Linn.*).—*A. Napellus var. hians* Goris in Bull. Sc. Pharmac. iii (1901) 112, fig. 28.—*A. hians* Watt. in Agric. Ledger (1902) no. 3, 101 (*non* Reichb.).—*A. dissectum* Watt. l.c. 100 (*partim necnon* D. Don).
Locality: *S.W.*: Razmak, 6,500 ft. (F. 1552 !).—N. of Razmak, below Springs, 7,700 ft. (B. & F. 1829 !).—Slope of Shuidar, 9,000-10,000 ft. (B. & F. 1551 !).—E. of Razmak, on hill, 6,800 ft. (B. & F. 1890 !).
In bud: 25-4-30 (Razmak).
Distribution: Subalpine and alpine zone of the W. Himalaya, from Chitral and Hazara to Kashmir, between 7,000 and 12,000 ft. (Stapf).

Aconitum sp.
Locality: *S.W.*: Razmak (F. 1857 ! 1930 !).

PÆONIA (Tourn.) L.

15 species.—Europe, Asia, W. N.-America.

***Paeonia albiflora** Pall. Fl. Ross. i, ii, 92, **var. sinensis** Steud.
Locality: *S.W.*: Razmak, in garden (B. & F. !).
Flowers: April.
Distribution: Siberia, China, Japan.

MENISPERMACEAE.

350 species.—Warm countries.

COCCULUS DC.

15 species.—Tropics and subtropics.

Cocculus pendulus Diels in Engl. Pflanzenr. iv (1910) 911.—*C. Leaeba* DC. Syst. i (1818) 529; Hook. f. in Fl. Brit. Ind. i (1872) 102.—*C. Cebatha* DC. Syst. i (1818) 527; Blatter Fl. Arab. pt. 1 (1919) 4.
Vernacular name: Jadhai, Parvatiae (Waziri).
Locality: *N.W.*: Dwa Warkha, abundant (Stewart).—Boya, 4,000 ft., found climbing on *Acacia modesta* (F. 1485 !).—E. of Miram Shah, 3,600 ft. (B. & F. 566 !).—Spinwam (B. & F. 861 !).
S.W.: Above Khirgi in Zam valley N.-W. of tank, hanging abundantly from the cliffs (Stewart).—Sararogha, 4,000 ft. (F. 41 ! 44 ! 85 ! 113 !).—Jandola, along Tank River (F. 709 ! 714 !).—Sarwekai (F. 3996 !).
Tank: (J. Williams 7961 ! Herb. Dehra Dun 7160 !).
Flowers: April; 18-6-1888 (Tank).
Distribution: Central and S. Africa, Abyssinia, Kordofan, Eritrea, Nubia, Egypt, Cape Verde Islands, Arabia, Afghanistan, Baluchistan, Kuram Valley, India.

BERBERIDACEAE.

200 species.—N. temperate regions, tropical mountains, S. America.

BERBERIS (Tourn.) L.

190 species.—N. hemisphere, S. America.

Berberis Lycium Royle Ill. 64.
Vernacular name: Sarghazie, Sakazie, Khadavanai (Waziri).
Locality: *N.W.*: On stony ground at foot of nearest hill E. of Spinwam, 2,800 ft. (B. & F. 761 ! 785 !).
S.W.: Razmak, 6,500 ft. (F. 1747 ! 2445 !).—Near Kaniguram, about 6,500 ft., also at 8,200 ft. (Stewart).—Wide shingle plateau of Tandachina (Stewart).—On a spur of the Pre Ghal (Stewart).—Between Makin and Razmak (Stewart).

Flowers: April, May.
Distribution: Baluchistan, Outer N.-W. Himalaya from Kashmir to Garhwal, 3,000-8,000 ft.

Berberis vulgaris L. Sp. Pl. (1753) 330, **var. Aitchisoni** in Herb. Dehra Dun.—*Var. calliobotrys* C. K. Schneider (*non* Bienert, Aitchison, Koehne).
Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15620 !).
Flowers & Fruit: 15-5-1895.
Distribution: Europe, temperate Asia.

Berberis umbellata Wall. Cat. (1828) no. 1475.
Vernacular name: Sakarzhai, Sarghazai (Waziri).
Locality: *N.W.*: Below Dossali Fort, side nala opening into the Khaisora River (B. & F. 1176 ! 1177 !).—Below Razmak Narai, 7,225 ft. (B. & F. 1198 !).—Razani (F. 2760 !).
S.W.: Razmak (F. 2802 ! 2813 ! 3072 !).
Flowers: 13-4-30 (Dossali); 30-4-27 (Razmak).
Distribution: Temperate Himalaya, 4,000-9,000 ft.
Uses: Browsed by camels; fruit eaten by man.

Berberis pachyacantha Koehne Deutsche Dendrol. (1893) 170.
Vernacular name: Sagharzae (Waziri).
Locality: *N.W.*: E. of Spinwam Fort, 2,650 ft. (B. & F. 684 !).
S.W.: N. of Razmak towards Springs, stony ground, 6,750-7,300 ft. (B. & F. 1784 !, F. 1843 !).
Flowers: 25-4-30 (Razmak).
Distribution: N.-W. Himalaya, 6,000-12,000 ft.
Uses: Fruit eaten.

Berberis zabeliana C. K. Schneider in Bull. Herb. Boiss. ser. ii (1905) 667.
Locality: *S.W.*: Razmak (F. 1832 !).
Flowers: 6-5-27 (Razmak).
Distribution: Kashmir, Upper Kagan Valley.

Berberis chitria Lindl. in Bot. Reg. (1823) t. 729.
Vernacular name: Sakazie (Waziri).
Locality: *S.W.*: Razmak (F. 3269 !).
Distribution: W. Himalaya, 6,000-9,000 ft.

PODOPHYLLUM *L.*

5 species.—N. temperate regions.

Podophyllum emodi Wall. Cat. 814.
Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15599 !).
Flowers & Fruit: 11-5-1895 (Pre Ghal).

PAPAVERACEAE.

600 species.—Chiefly N. temperate region.

PAPAVER Tourn. ex L.

110 species.—Europe, Asia, America, S. Africa, Australia.

Papaver pavoninum F. & M. Ind. Sem. Hort. Petrop. ix, 82 (*non* Boiss. & Buhse).
Locality: *N.W.*: Datta Khel (B. & F. 1336a !).
S.W.: Wana, 4,500 ft. (Duthie's Collect. 15630 !).
Flowers & Fruit: 16-4-30 (Datta Khel); 1-5-1895 (Datta Khel).
Distribution: Turkestan, Baluchistan, Afghanistan.

Papaver pavoninum F. & M. Ind. Sem. Hort. Petrop. ix (1838) 82, **var. incornutum** Fedde in Engler's Pflanzenr. iv, 104 (1909) 334.
Vernacular name: Kakavai (Waziri).
Locality: *N.W.*: Datta Khel village, along irrigation channel, 4,600 ft. (B. & F. 1446 !).
Flowers & Fruit: 17-4-30 (Datta Khel).
Distribution of var.: N. Persia, W. Turkestan?

Papaver pavoninum var. Freynei Fedde in Engl. Pflanzenr. iv, 104 (1909) 334.
Locality: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1352 !).
Flowers & Fruit: 16-4-30 (Datta Khel).
Distribution: N. Persia.

Papaver rhoeas L. Sp. Pl. (1758) 507; Boiss. Fl. Or. i (1867) 113.
Vernacular name: Zirdgul, Kolejhdarai (Waziri).
Locality: *N.W.*: Razani, 5,000 ft., in fields (F. 2152 ! 2560 !).
S.W.: Razmak, 6,500 ft. (F. 2300 !).
Flowers: April, May.
Fruit: May.
Distribution: Europe, N. Africa, W. Asia, Arabia, Mesopotamia, Kashmir, Tibet.

Papaver dubium L. Sp. Pl. (1753) in append. 1196.
Locality: *S.W.* (Stewart).
Distribution: Central Europe, Macaroesia, Mediterranean, Orient, Abyssinia, N. Africa.

Papaver dubium L. Sp. Pl. (1753) in append. 1196, **var. laevigatum** (M. B.) Elkan ex Fedde in Engl. Pflanzenr. iv, 104 (1909) 318.
Locality: *N.W.*: Dwa Warkha (Stewart).
Distribution: Mediterranean, Orient to N.-W. Himalaya.

Papaver Decaisnei Hochst. & Steud. in Schimp. Pl. Arab. exs. (1835) no. 125 ex Boiss. in Ann. Sc. Nat. 2, ser. xvi (1845) 372.
Locality: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1336 !).—Bed of Khunai River, above Dossali Fort, 5,050 ft. (B. & F. 1084 ! 1130 !).—Razani (F. 2152 ! 2560 !)..—E. of Miram Shah, hills, 3,550 ft. (B. & F. 544 !).—N. of Datta Khel, in shade of trees (B. & F. 588 !).
S.W.: W. of Razmak, stony plain, 6,800 ft. (B. & F. 1713 ! 1954 !).
Flowers & Fruit: 29-3-30 (Miram Shah); 12-4-30 (Dossali); 16-4-30 (Datta Khel); 23-4-27 (Razani); 24-4-30 (Razmak).
Distribution: Mediterranean, Persia.

Papaver Decaisnei var. Dielsianum Fedde in Engl. Pflanzenr. iv, 104 (1909) 344.
Vernacular name: Pir khatel (Waziri).
Locality: *N.W.*: E. of Miram Shah Fort, hills, 3,600 ft. (B. & F. 581 !).—Below Dossali Fort, left bank of Khaisora River (B. & F. 1147 !).
Flowers: 29-3-30 (Miram Shah); 13-4-30 (Dossali).
Distribution: Kuram Valley, Baluchistan.

Papaver hybridum L. Sp. Pl. (1753) 506.
Locality: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1353 !).
Flowers & Fruit: 16-4-30 (Datta Khel).
Distribution: Central Europe, Mediterranean, Central Asia.

Papaver nudicaule L. Sp. Pl. (1753) 507.
Nota: *Tota planta glaberrima.*
Vernacular name: Kakavai (Waziri).
Locality: *N.W.*: Datta Khel village, in cultivated ground, 4,600 ft. (B. & F. 1445 !).
Flowers: 17-4-30.
Distribution: Arctic and N. part of subarctic region, subarctic Asia, Central Asia, temperate E. Asia, Afghanistan, W. Himalaya, 16,000-17,000 ft.

Papaver somniferum L. Sp. Pl. (1753) 508; Boiss. Fl. Or. i (1867) 116.—*P. opiiferum* Forsk. Fl. Aegypt.—Arab. (1775) cxiii, no. 336.
Vernacular name: Afin; Kolijhdarai (Waziri).
Locality: *N.W.*: Miram Shah, cultivated (F. 300 ! 301 ! 311 ! 860 !).—Datta Khel village, 4,600 ft. (B. & F. 1430 ! 1492 !).—Razani (F. 2148 !).
Flowers & Fruit: April.
Distribution: Generally cultivated in the warm and temperate regions of Europe, Asia and N. Africa.

HYPECOUM Tourn. ex L.

18 species.—Mediterranean, Central Asia.

Hypecoum procumbens L. Sp. Pl. (1753) 181; Boiss. Fl. Or. i (1867) 124.
Locality: *S.W.*: Razmak (Stewart).
Distribution: Canaries, Mediterranean region, Arabia, Mesopotamia, Kuram Valley, Baluchistan, Punjab.

Hypecoum pendulum L. Sp. Pl. (1753) 124; Schenk Sp. Pl. it. Aeg. Arab. Syr. (1840) 45.
Vernacular name: Margaypal, Zirgulaki.
Locality: *N.W.*: Boya, 4,000 ft., along canal (F. 1030 ! 1158 !).—W. of Datta Khel, stony plain, 4,600 ft. (B. & F. 610 ! 1334 !).—E. of Miram Shah, stony plain, 3,150 ft. (B. & F. 505 ! 970 !).—N. of Dossali (B. & F. 1038 !).
Flowers & Fruit: 21-3-30 (Boya); 30-3-30 (Datta Khel); 9-4-30 (Miram Shah); 10-4-30 (Dossali); 16-4-30 (Datta Khel).
Distribution: Mediterranean region, Egypt, Arabia, Persia, Baluchistan, Afghanistan, Turkestan.
Uses: Extract used as a cooling drink (F.).

Hypecoum parviflorum Kar. & Kir. in Bull. Soc. natural. Moscou xv. (1842) 141, no. 54.
Vernacular name: Kiaspotai.
Locality: *Tank*: Beyond Tank, on hill (J. Williams 9135 !).
Flowers: 12-5-1888 (Tank).
Distribution: Soongaria, Desert of Syria?

RŒMERIA Medic.

10 species.—Mediterranean to Afghanistan.

Roemeria hybrida (L.) DC. Syst. ii (1821) 92.
Locality: *S.W.*: Barwand, 4,000 ft. (Duthie's Collect. 15726).
Flowers & Fruit: 26-4-1895 (Barwand).
Distribution: Mediterranean, Orient, Afghanistan.

Roemeria hybrida (L.) DC. **var. eriocarpa** DC. Syst. ii (1821) 93.
Locality: *N.W.*: Boya, cultivated fields, 3,550 ft. (F. 1096 !).
Flowers & Fruit: 5-4-27.
Distribution: Of type.

Roemeria dodecandra (Forsk) Stapf Ergebn. Polak. Exp. Pers. in Denkschr. Akad Wien li (1886) 295.—*R. orientalis* Boiss. in Ann. Sc. nat. ser. 2, xvi (1841) 374.
Locality: *N.W.*: Boya, right bank of Tochi River, on gravel, 3,550 ft. (B. & F. 1673 !).
Flowers & Fruit: 21-4-30 (Boya).
Distribution: Mediterranean, Orient, Baluchistan, Afghanistan.

FUMARIA Tourn. ex L.

40 species.—Europe, Asia, Africa, chiefly Mediterranean.

Fumaria Vaillantii Loisel. in Desv. Journ. Bot. ii (1809) 358, *et* Notice (1810) 102; Pugsley in Journ. Linn. Soc. xliv (1919) 315.
Vernacular name: Chaniae (Waziri).
Locality: *S.W.*: Razmak (F. 1660 ! 2285 !).
Flowers & Fruit: 7-5-27 (Razmak).
Distribution: From Spain across Europe to the Altai Mts. and Indian frontier, Kuram Valley, Afghanistan.

Fumaria asepala Boiss. Fl. Or. i (1867) 135.
Vernacular name: Shavtora (Waziri).
Locality: *N.W.*: Near Datta Khel village, 4,600 ft. (B & F. 1431 !).—Miram Shah, on a grave, 3,150 ft. (B. & F. 25 !).
Flowers & Fruit: 19-3-30 (Miram Shah); 17-4-30 (Datta Khel).
Distribution: Persia, Turkestan, Mesopotamia, Kurdistan,

Fumaria Schrammii Pugsley in Journ. Linn. Soc. xliv (1919) 319.—*F. Vaillantii var. Schrammii* Haussk. in Flora lvi (1873) 444.
Locality: *N.W.*: Razani (F. 2062 !).
Flowers & Fruit: 20-4-27 (Razani).
Distribution: Kashmir, Chitral, Persia, Turkestan, Transcaucasus, Europe.

Fumaria parviflora Lam. Encycl. Meth. ii (1788) 567.—*F. tenuifolia* Roth. Catal. fasc. ii (1800) 82.
Vernacular name: Lavang (Waziri).
Locality: *N.W.*: Dwa Warkha (Stewart).—Datta Khel (F. 1206 ! 1210 ! B. & F. 1342 !).
S.W.: To Razmak (Stewart, F. 2245 !).
Flowers & Fruit: 25-3-27 (Datta Khel); 7-5-27 (Razmak).
Distribution: Europe, Mediterranean, Canaries, N. Africa, to Afghanistan and Baluchistan.

Fumaria indica Pugsley in Journ. Linn. Soc. xliv (1919) 313.—*F. Vaillantii var. indica* Haussk. in Flora lvi (1873) 443.—*F. parviflora subsp. Vaillantii* Hook. f. Fl. Brit. Ind. i (1872) 128.
Vernacular name: Levanai, Lavang, Margyapal, Sevae, Parparie (Waziri).
Locality: *N.W.*: Datta Khel (F. 1208 ! 1250 !).—Boya (F. 562 ! 1008 ! 1034 !).—Miram Shah, in plain, 3,150 ft. (B. & F. 134 ! 640 !, F. 490 !).
S.W.: Razmak (F. 2288 !).
Flowers & Fruit: 22-3-30 (Miram Shah); 25-3-27 (Datta Khel); 8-4-27 (Boya); 7-5-27 (Razmak).
Distribution: W. Himalaya, Baluchistan, Afghanistan, Persia, Turkestan, Soongaria, Mongolia.
Uses: An extract of this plant is drunk for the purpose of cooling the body and also applied externally for the same purpose.

CRUCIFERAE.

(The specimens collected by Blatter and Fernandez were kindly identified by O. E. Schulz of Berlin.; see Fedde; Rep. xxxi (1933) 162-168.)

1,900 species.—Cosmopolitan, but chiefly N. temperate and especially Mediterranean.

NASTURTIUM L.

50 species.—Cosmopolitan.

Nasturtium officinale R. Br. Hort. Kew. ed. 2, iv, 109.

Vernacular name: Thermera, Dalamira (Waziri).
Locality: *N.W.*: Boya Fort, bed of Tochi River, 3,550 ft. (B. & F. 91 !, F. 534 !).—Datta Khel, 4,600 ft. (F. 1266 ! 1310 ! 1326 !).
S.W.: Jandola, along Tank River, 2,270 ft. (F. 747 ! 751 ! 753 ! 755 ! 767 ! 774 !).—Sarwekai, along stream of brackish water, 3,500 ft. (F. 4156 ! 4160 ! 4161 ! 4395 !).—Wana, along stream, 4,500 ft. (F. 3621 !).
Flowers: 21-3-30 (Boya).
Distribution: Temperate regions of N. hemisphere.

Nasturtium officinale R. Br. **var. microphyllum** Boenningh.
Vernacular name: Dalamira (Waziri).
Locality: *N.W.*: Datta Khel, 4,600 ft. (F. 1243 ! 1322 !).
S.W.: Jandola, along Tank River, 2,270 ft. (F. 762 ! 765 ! 792 !).
Uses: Eaten as greens and also cooked with meat.

Nasturtium sp.
Locality: *S.W.*: About Kaniguram (Stewart).

ARABIS L.

220 species.—N. temperate and S. American.

***Arabis albida** Stev. in Fisch. Cat. Hort. Gorenk. 51.
Vernacular name: Rock-Cress.
Locality: *S.W.*: Razmak, in garden (B. & F. !).

Flowers: April.
Distribution: Europe, Mediterranean, Orient.

BARBAREA R. Br.

15 species.—N. temperate.

Barbarea vulgaris Br. Hort. Kew. ed. 2, iv, 109.
Locality: *S.W.*: Near Kaniguram brook (Stewart).
Distribution: Temperate and subalpine Himalaya, 6,000-10,000 ft., Orient, Europe, N. & S. Africa, Australia.

NOTOCERAS R. Br.

2 species.—Mediterranean.

Notoceras canariense R. Br. Hort. Kew ed. 2, iv, 117.
Locality: *N.W.*: Shewa Post, bed of Volam River, 2,150 ft. (B. & F. 902 !).—W. of Spinwam Fort, slopes of Chota Darweshta, gravel and boulders, 2,750-3,000 ft. (B. & F. 699a !).—W. of Spinwam Fort, stony plain, 2,650 ft. (B. & F. 849 !).—Near Miram Shah Fort, bank and bed of Chasmai River, gravel and sand, 3,100 ft. (B. & F. 254 ! 286 !).—E. of Miram Shah Fort, stony plain, on sand, gravel and clay, 3,150 ft. (B. & F. 158 ! 159 !).—Dwa Warkha (Stewart).
Flowers: 23-3-30 (Chasmai); 2-4-30 (Chota Darweshta); 5-4-30 (Shewa Post).
Distribution: Baluchistan, Afghanistan, N.-W. India, Arabia, Mediterranean, Canaries.

FARSETIA Turra.

10 species.—E. Mediterranean.

Farsetia Hamiltonii Royle Ill. Bot. Himal. (1839) 71.
Locality: *N.W.*: Spinwam Fort, bank of Kaitu River, on sand (B. & F. 753 !).
Flowers: 2-4-30 (Spinwam).
Distribution: Sind, Afghanistan, Arabia, Algeria.

Farsetia Jacquemontii Hook. f. & Th. in Journ. Linn. Soc. v (1861) 148.
Locality: *Tank*: Pass of Zam near Tank (J. Williams 7767).
Flowers: 5-7-1888 (Tank).
Distribution: N. India, Sind, Baluchistan, Rajputana Desert, Afghanistan.
Uses: Much preferred by camels, less by goats, least by cattle (J. Williams).

ALYSSUM Tourn. ex L.

120 species.—Mediterranean, Europe.

Alyssum desertorum Stapf in Denkschr. Akad. Wien (1886) 33.
Locality: *N.W.*: Plain E. of Miram Shah, sandy clay, 3,150 ft. (B. & F. 153 !).—Near Miram Shah, bed of Chasmai River, gravel and sand, 3,100 ft. (B. & F. 252 !).—Gravel plain S. of Miram Shah, 3,150 ft. (B. & F. 478 !).—Near Datta Khel village, 4,600 ft. (B. & F. 1449a !).— Boya, bed of Tochi River, 3,550 ft. (F. 542 !), in fields (F. 1043 ! 1118 ! 1121 ! 1123 ! 1131 !).
Flowers: 22-3-30 (Miram Shah); 28-3-30 (Miram Shah).
Distribution: Persia, Mesopotamia.

Alyssum marginatum Steud. Nom. ed. ii, i, 68.
Locality: *N.W.*: Gravel plain W. of Datta Khel Fort, 4,600 ft. (B. & F. 617 !).—Stony plain E. of Datta Khel, 4,600 ft. (B. & F. 1350 ! 1377 !).—Boya, open stony plain (F. 906 ! 937 !).
Fruit: 30-3-30 (Datta Khel).
Distribution: Baluchistan, Afghanistan, Persia, Arabia.

DESCURAINIA Webb. & Berth.

18 species.—N. temperate, S. America.

Descurainia sophia (L.) Webb. ex Prantl in Engl. & Prantl Pflanzenf. iii, 2 (1890) 192.

Locality: *N.W.*: Miram Shah Fort, 3,150 ft. (B. & F. 637 !).—E. of Miram Shah Fort, stony plain (B. & F. 969 !).—Boya, cultivated ground (F. 1125 !).—Datta Khel (F. 1205 ! 1223 !).

S.W.: Wana, 4,500 ft. (Duthie's Collect. 15656 !).—In the upper regions (Stewart).

Flowers & Fruit: 31-3-30 (Miram Shah); 2-5-1895 (Wana).

Distribution: Mediterranean, Europe, Arctic region, Central Asia, Baluchistan, Afghanistan, temperate E. Asia.

Descurainia sophia (L.) Webb. **forma exilis** O. E. Schulz.

Locality: *N.W.*: Plain E. of Miram Shah Fort, in meadow, locally abundant, 3,150 ft. (B. & F. 141 !).—Datta Khel Fort, on gravel, 4,600 ft. (B. & F. 1393 !).

Flowers: 22-3-30 (Miram Shah); 17-4-30 (Datta Khel).

MALCOLMIA R. Br.

35 species.—Mediterranean.

Malcolmia africana (L.) R. Br. Hort. Kew. ed. 2. iv, 121.

Vernacular name: Kurar.

Locality: *N.W.*: Near Miram Shah Fort, bed of Chasmai River, gravel and sand, 3,100 ft. (B. & F. 264 !).—N. of Miram Shah Fort, clayey bank of channel 3,150 ft. (B. & F. 468 !).—Miram Shah village, bed of Tochi River, gravel and sand, 3,150 ft. (B. & F. 503 !).—Datta Khel (F. 1225 ! 1228 ! 1230 ! 1323 !).

S.W.: N. of Razmak Camp, towards Springs (F. 2281 !).—Zam valley, above Kirge (Stewart).

Flowers: 23-3-30 (Chasmai).

Distribution: Punjab, Kashmir, W. Tibet, up to 13,000 ft., Baluchistan, Orient, Mediterranean.

Uses: Eaten by animals.

Malcolmia africana (L.) R. Br. **var. trichocarpa** Boiss. Fl. Or. i, 223.

Vernacular name: Shingulaki (Waziri).

Locality: *N.W.*: Shewa Post, bed of Kuram River, 2,150 ft. (B. & F. 920 !).—Khajuri Fort, bed of Tochi River, gravel and sand, 2,250 ft. (B. & F. 419 !).—E. of Miram Shah Fort, plain, gravel and sand, 3,150 ft. (B. & F. 148 ! 160 ! 978 !).—Boya, fields and stony broken ground, 3,550 ft. (F. 1151 !).

Flowers: 26-3-30 (Khajuri); 5-4-27 (Boya); 5-4-30 (Shewa Post).

Distribution: Persia.

Malcolmia strigosa Boiss. Ann. Sc. Nat. (1842) 70.

Vernacular name: Kazbira, Pevra.

Locality: *N.W.*: Shewa Post, bed of Volam River, sand, 2,150 ft. (B. & F. 892 !).—W. of Miram Shah Fort, stony plain on gravel, 3,150 ft. (B. & F. 1 !).—E. of Miram Shah Fort, sand near water channel (B. & F. 125 ! 136 ! 137 ! 163 ! 315 !).—Near Anghar village (Lieut. Meynell 753b !).—Boya, open stony plain, 3,550 ft. (F. 902 !).—W. of Datta Khel Fort, gravel plain, 4,600 ft. (B. & F. 614 !).—E. of Datta Khel Fort, stony plain (B. & F. 1351 !).—Datta Khel (F. 1195 ! 1196 ! 1197 ! 1198 ! 1215 !).

Flowers: 19-3-30 (Miram Shah); 22-3-30 (Miram Shah); 30-3-30 (Datta Khel); 5-4-30 (Shewa Post).

Distribution: Afghanistan, Baluchistan, Persia.

Malcolmia strigosa Boiss. **var. macrantha** O. E. Schulz. Notizbl. Bot G. u. Mus. Berlin Dalhelm 9 (90) (1927) 1087.

Locality: *N.W.*: Near Miram Shah Fort, right bank and bed of Chasmai River, 3,100 ft. (B. & F. 208 ! 214 ! 290 !).—E. of Miram Shah Fort, stony plain, on sand, 3,150 ft. (B. & F. 133 !).—Miram Shah (F. 808 !).—Boya Fort, right bank of Tochi River 3,550 ft. (B. & F. 105 !), open stony plain (F. 905 !).—Datta Khel village, nala 4,600 ft. (B. & F. 1474 !).—Datta Khel (F. 1212 ! 1214 ! 1230 !).

S.W.: Barwand, 4,000 ft. (Duthie's Collect. 15701 ! 15716 !).

Flowers: 23-3-30 (Chasmai); 17-4-30 (Datta Khel); 27-4-1895 (Barwand).

Fruit: 23-3-30 (Chasmai); 17-4-30 (Datta Khel); 27-4-1895 (Barwand).

Distribution of type: Baluchistan, Afghanistan, Persia.

Malcolmia strigosa var. macrantha, forma incana O. E. Schulz. l.c. 1088.
Locality: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15627 !).
Flowers: 1-5-1895 (Wana).

***Malcolmia maritima** (L.) R. Br. Hort. Kew. ed. 2, iv, 121.
Trade name: Virginia Star.
Locality: *N.W.*: Miram Shah, Officers' garden, cultivated, 3,150 ft. (B. & F. 627 !).
Flowers: 31-3-30
Distribution: Mediterranean.

ALLIARIA Marsh, DC.

5 species.—Temperate Europe, Asia.

Alliaria officinalis Andrz. *ap.* Marsh.—Bieberst. Fl. Taur.—Cauc. iii (1819) 445.
Locality: *S.W.*: N. of Razmak Camp, below Springs, 7,700 ft. (B. & F. 1820 !).—E. of Razmak, hillside, above 6,800 ft. (B. & F. 1911 !).— Razmak (F. 2316 !).
Flowers: 25-4-30 (Razmak).
Distribution: Europe, Mediterranean, Orient, Central Asia.

SISYMBRIUM (Tourn.) L.

50 species.—N. temperate regions of the Old World.

Sisymbrium irio L. Sp. Pl. (1753) 921.
Locality: *N.W.*: Miram Shah Fort, gravel, 3,150 ft. (B. & F. 26 !).—E. of Miram Shah Fort, sand near water channel (B. & F. 126 ! 138 !).—in the plains (Stewart).
Tank (J. Williams 7106 !).
Flowers: 19-3-30 (Miram Shah); 11-5-1888 (Tank).
Distribution: Mediterranean, Europe, N. Africa, Orient, Baluchistan, Punjab, Rajputana Desert, China.

Sisymbrium irio L. **forma minimum** Pourret.
Locality: *N.W.*: Miram Shah village, clayey bank of irrigation channel, 3,150 ft. (B. & F. 450 !).—Miram Shah Fort (B. & F. 524 !).
Flowers: 28-3-30 (Miram Shah village).

Sisymbrium irio L. **var. dasycarpum** O. E. Schulz.
Locality: *N.W.*: E. of Miram Shah Fort, hills, 3,600 ft. (B. & F. 582 !).—Miram Shah (F. 382 ! 522 !).
Flowers: 29-3-30 (E. of Miram Shah).

ARABIDOPSIS Schur.

11 species.—Europe, W. Asia.

Arabidopsis campestris O. E. Schulz.
Locality: *N.W.*: Loargai Narai, 6,600 ft. (B. & F. 1306 ! 1314 !).
S.W.: N. of Razmak Camp, towards Springs, 6,750-7,300 ft. (B. & F. 1778 !).—E. of Razmak Camp, grassy slope of hills (B. & F. 1915 ! 1958 !).—Razmak (F. 3149 !).
Flowers: 16-4-30 (Loargai Narai); 25-4-30 (Razmak).

Arabidopsis Wallichii (Hook. f. & Th.) Busch in Fl. Cauc. crit. iii, 4 (1909) 457 *in obs.*
Locality: *S.W.*: N. of Razmak Camp, below Springs, 7,700 ft. (B. & F. 1857 !).—S.W. of Razmak Camp, on hillside, 6,950 ft. (B. & F. 1945 !).
Flowers: 25-4-30 (Razmak).
Distribution: W. Himalaya, Salt Range, Afghanistan.

CORONOPUS Rupp. ex L.

20 species.—Subtropics, Europe.

Coronopus didymus (L.) Smith **forma pilosus** O. E. Schulz.
Locality: *N.W.*: Plain E. of Miram Shah Fort, flat on sand near water,

3,150 ft. (B. & F. 140 !).—Miram Shah Fort, Officers' garden, 3,150 ft. (B. & F. 610 !).
Flowers: 22-3-30 (Miram Shah); 31-3-30 (Miram Shah).
Fruit: 22-3-30 (Miram Shah).

Brassica (Tourn.) L.

85 species.—Europe, Mediterranean, Asia.

***Brassica campestris** L. Sp. Pl. (1753) 666.
Locality: *N.W.*: Miram Shah village, cultivated (B. & F. 489 !).
Flowers: 28-3-30.
Distribution: Cosmopolitan, cultivated.

***Brassica campestris** L. **subsp. Napus** L.
Locality: Waziristan (Duthie's Collect. 15743).
Distribution: Cultivated throughout India.

***Brassica oleracea** L. Sp. Pl. (1753) 667.
Locality: *N.W.*: Miram Shah Fort, cultivated, 3,150 ft. (B. & F. 646 ! 647 ! 647a !).
Flowers: 31-3-30 (Miram Shah).
Distribution: Cosmopolitan, cultivated.

Diplotaxis DC.

20 species.—Europe, Mediterranean.

Diplotaxis Griffithii Hook. f. & Th. in Hook. f. Fl. Brit. Ind. i, 388.
Vernacular name: Tarmerai, Katel (Waziri).
Locality: *N.W.*: Shewa Post, left bank of Volam River, 2,150 ft. (B. & F. 868 !).—Spinwam, banks of Kaitu River (Lieut. Meynell 254a !).—E. of Spinwam Fort, sandstone ridge, 2,800 ft. (B. & F. 779 !).—Spinwam Fort, bed of Kaitu River, 2,650 ft. (B. & F. 445 !).—Near Miram Shah, bed of Chasmai River, on sand and gravel, 3,100 ft. (B. & F. 249 !).—Miram Shah village, bed of Tochi River, gravel and sand, 3,150 ft. (B. & F. 496 !).—Anghar village, (Lieut. Meynell 753a !).—W. of Miram Shah Fort, on sand in river-bed, 3,150 ft. (B. & F. 2 !).—Hills E. of Miram Shah Fort, 3,550 ft. (B. & F. 548 !).—Miram Shah (F. 396 ! 416 ! 809 !).
S.W.: Dargai Post, 3,790 ft. (F. 3781 !).
Flowers: 23-3-30 (Chasmai); 27-3-30 (Spinwam); 3-4-30 (Spinwam); 5-4-30 (Shewa Post).
Distribution: Punjab, Afghanistan, Baluchistan.
Uses: Eaten as greens.

Eruca Tourn. ex Adans.

10 species.—Mediterranean.

Eruca sativa Gars. Traité pl. anim. ii (1767) 166, t. 259.
Locality: *N.W.*: S. of Miram Shah Fort, stony plain, 3,150 ft. (B. & F. 975 !).
Flowers: 9-4-30.
Distribution: Europe, Mediterranean, N. Africa, Orient, Brit. India, Turkestan, China.

Eruca sativa Gars. **var. eriocarpa** (Boiss.) Post. Fl. Syr. Palest. Sin. (1883-96) 79.
Locality: *N.W.*: Datta Khel village, in nala, 4,600 ft. (B. & F. 1503 !).
Flowers: 17-4-30 (Datta Khel).

Douepia Camb.

1 species.—N.-W. India, Sind.

Douepia tortuosa Camb. in Jacq. Voy. Ind. iv, Bot. (1844) 18, t. 18.—*Moricandia tortuosa* Hook. f. & Th. in Journ. Proc. Linn. Soc. Bot. v (1861) 172.
Locality: *Tank* (J. Williams 7768 ! 7958 !).
Fruit: 23-6-1888.

Distribution: N.-W. India, Sind.
Uses: Decoction of its flowers rubbed on for eczema (J. Williams).

MORICANDIA DC.

10 species.—Mediterranean.

Moricandia sinaica Boiss. Fl. Or. i (1867) 386.
Vernacular name: Leiloghul (Waziri).
Locality: *N.W.*: Boya Fort, bed of Tochi River, 3,550 ft. (B. & F. 90 !, F. 1127 ! 1128 !).—Shakai, 6,000-7,000 ft. (Duthie's Collect. 15696 !).
Flowers: 21-3-30 (Boya); 30-4-1895 (Shakai).
Fruit: 30-4-1895 (Shakai).
Distribution: Baluchistan, Persia, Arabia, Egypt.

LEPIDIUM L.

100 species.—Cosmopolitan.

Lepidium draba L. Sp. Pl. 645.
Locality: *S.W.*: Barwand, 4,000 ft. (Duthie's Collect. 15710 !).—Wana, 4,500 ft. (Duthie's Collect. 15663 !).
Flowers & Fruit: 26-4-1895 (Barwand); 4-5-1895 (Wana).
Distribution: S. Europe, Orient, Afghanistan, Punjab, Baluchistan.
Uses: Eaten with bread; said to possess antiscorbutic properties; also controls bleeding if used raw; used as stomachic and tonic (Herb. Dehra Dun).

Lepidium draba L. **subsp. chalepense** (L.) Thell.
Vernacular name: Bashka (Waziri).
Locality: *N.W.*: Miram Shah village, in fields, 3,150 ft. (F. 832 !).

Lepidium draba L. **subsp. chalepense** (L.) Thell. **var. typicum** Thell. **forma glabratum** Thell.
Locality: *N.W.*: Boya, fields, 3,150 ft. (F. 1095 !).
S.W.: Razmak, gravel plain, common, 6,800 ft. (B. & F. 1745 ! 1988 !).
Flowers: 24-4-30 (Razmak).

forma pubescens DC.
Locality: *N.W.*: Near Miram Shah Fort, bank of Chasmai River, 3,100 ft. (B. & F. 291 !).—Above Chasmai River, in fields (B. & F. 341 !).—Stony plain E. of Miram Shah Fort (F. 492 !).—N. of Miram Shah Fort (B. & F. 466 !).—Boya, 3,550 ft. (F. 566 ! 1027 ! 1173 !, B. & F. 75 !).—Datta Khel village, 4,600 ft. (B. & F. 1211 ! 1213 ! 1439 !).
S.W.: Slope of Shuidar, 7,000-9,000 ft. (B. & F. 1569 !).
Flowers: 23-3-30 (Chasmai); 28-3-30 (Miram Shah); 17-4-30 (Datta Khel).

forma canescens DC.
Locality: *N.W.*: Near Miram Shah Fort (B. & F. 235 !).
Flowers: 23-3-30 (Miram Shah).

var. repens (Schrenk) Thell.
Locality: *S.W.*: N. of Razmak, below Springs, 7,700 ft. (B. & F. 1819 !, F. 1588 ! 1699 ! 2368 ! 2780 ! 3089 ! 3094 !).—Sararogha, 4,000 ft. (F. 83 !).
Flowers: 25-4-30 (Razmak).

***Lepidium sativum** L. Sp. Pl. (1753) 899.
Vernacular name: Halayo.
Locality: *N.W.*: Miram Shah village, 3,150 ft. (B. & F. 192 !).
Tank (J. Williams 7101 !).
Flowers: 28-3-30 (Miram Shah); 15-5-1888 (Tank).
Distribution: Cultivated everywhere.
Uses: Used medicinally.

THLASPI (Tourn.) L.

60 species.—N. temperate regions.

Thlaspi alpestre L. Sp. Pl. ed. ii, 903.—*T. Griffithianum* Boiss. Fl. Or. i (1867) 329.

Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15609 !).
Flowers: 17-5-1895 (Pre Ghal).
Distribution: Afghanistan, temperate and subalpine Himalaya, Alps of Europe, Asia, America, Andes.

Thlaspi arvense L. Sp. Pl. 641.
Locality: *S.W.*: Razmak (Stewart).
Distribution: Throughout the temperate and subalpine Himalaya, Asia, Europe.

Thlaspi cochleariforme DC. Syst. ii, 381.
Locality: *S.W.*: N. of Razmak Camp, slopes of Shuidar, 8,000-9,000 ft. (F. 1617 !).
Flowers: 8-5-27.

Thlaspi praecox Wulfen. in Jacq. Coll. ii, 121, t. 9.
Locality: *S.W.*: Slope of Shuidar, 9,000-10,900 ft. (B. & F. 1520 ! 1521 !).
Flowers: 18-4-30.
Distribution: Mediterranean.

IBERIS Dill. ex L.

30 species.—Europe, Asia.

***Iberis amara** L. Sp. Pl. (1753) 649.
Locality: *N.W.*: Miram Shah Fort, cultivated, 3,150 ft. (B. & F. 524 !)
Flowers: 28-3-30.

NESLIA Desv.

1 species.—Europe, Mediterranean, N. Asia.

Neslia paniculata Desv. Journ. iii, 162.—*Vogelia paniculata* (L.) Hornem. Hort. Hafn. ii, 594.
Locality: *N.W.*: Razani, 5,000 ft. (F. 2129 ! 2155 !); Datta Khel village, nala, 4,600 ft. (B. & F. 1499 !, F. 1226 !).
Tank (J. Williams in Herb. Dehra Dun).
Distribution: Punjab-Himalaya, Kashmir, Baluchistan, Afghanistan, Persia, W. Asia, temperate Europe.

EUCLIDIUM R. Br.

1 species.—E. Mediterranean.

Euclidium syriacum (L.) R. Br. in Hort. Kew. ed. 2, iv, 74.
Locality: *N.W.*: Datta Khel village, 4,600 ft. (F. 1234 !).
Distribution: Kashmir, Punjab, Baluchistan, Afghanistan, Soongaria, westwards to Central Europe.

CRAMBE Tourn. ex L.

20 species.—Europe, Mediterranean, Asia, Polynesia, Patagonia.

Crambe cordifolia Steven in Mem. Soc. nat. Mosc. iii (1812) 267, **var kotschyana** (Boiss.) O. E. Schulz. in Engler Pflanzenr. iv, 105 (1919) 236.
Vernacular name: Navgra (Waziri).
Locality: *S.W.*: Shuidar, 9,000-10,000 ft. (F. 1595 !).
Distribution: Baluchistan, Afghanistan, Persia, Central Asia.

RAPHANUS (Tourn.) L.

10 species.—Mediterranean, Europe, Java.

***Raphanus sativus** L. Sp. Pl. (1753) 935.
Vernacular name: Radish.
Locality: *N.W.*: Miram Shah village, cultivated, 3,100 ft. (B. & F. 490 !).
Flowers: 28-3-30.
Distribution: Old World, temperate regions.

GOLDBACHIA DC.

2 species.—N. temperate regions of Old World and Yunnan.

Goldbachia laevigata DC. Syst. ii (1821) 577.—*G. tetragona* Led. Ind. Sem. h. Petrop. (1822) 9.—*G. torulosa* DC. Syst. ii, 577.
Locality: *N.W.*: Razani (Stewart).
Distribution: Kashmir, 5,000 ft., Punjab, westwards to S. Russia.

CHORISPORA R. Br.

12 species.—E. Mediterranean, Central Asia.

Chorispora tenella DC. Syst. ii, 435.
Locality: *N.W.*: Plain N. of Boya Fort towards Tochi on sand, 3,550 ft. (B. & F. 77 ! 115 !).—On cultivated ground (F. 1169 !).—4 miles from Datta Khel Fort, wayside under shade of trees (B. & F. 596 !).—Datta Khel village, clayey bank of irrigation channel, 4,600 ft. (B. & F. 1498a !).—Datta Khel (F. 1209 ! 1231 !).
S.W.: Slopes of Shuidar, 7,000-9,000 ft. (B. & F. 1584).
Flowers: 21-3-30 (Boya); 30-3-30 (Datta Khel); 18-4-30 (Shuidar).
Distribution: Asia Minor, Orient, Afghanistan, Baluchistan.

CAPPARIDACEAE.

450 species.—Tropical and warm temperate regions.

CLEOME L.

70 species.—Tropics and subtropics.

Cleome papillosa Steud. Nomencl. ed. 2, i (1840) 382; Boiss. Fl. Or. i (1867) 413.—*C. linearis* Stocks ex T. Anders. in Journ. Linn. Soc. v, Suppl. i (1860) 3.
Locality: *N.W.*: Lower regions (Stewart).
Distribution: Kordofan, Nubia, Abyssinia, Somaliland, Eritrea, extending through Arabia to Baluchistan, Sind, Rajputana.

Cleome brachycarpa Vahl. ex DC. i (1824) 240; Boiss. Fl. Or. i (1867) 412.
Locality: *N.W.*: Shewa Post, bank of Volam River (B. & F. 881 ! 910 !).—E. of Spinwam Fort, sandstone ridge, 2,800 ft. (B. & F. 805 !).
S.W.: Razmak, stony ground, 6,500 ft. (F. 1532 ! 1538 !).
Flowers: 3-4-30 (Spinwam); 5-4-30 (Shewa Post); June.
Fruit: 5-4-30 (Shewa Post); June.
Distribution: Kordofan, Abyssinia, Nubia, Somaliland, Socotra, Central & S. Arabia, Baluchistan, Punjab, Sind.

Cleome sp.
Poor material, very likely *C. simplicifolia* Hook. f. & Th.
Locality: *N.W.*: Miram Shah, 3,000 ft. (F. 393 !).

CAPPARIS (Tourn.) L.

200 species.—Warm regions.

Capparis decidua Edgew. in Journ. Linn. Soc. v (1862) 184; Pax in Engl. & Prantl. Pflanzenf. iii, pt. 2, 230, 231.—*Sodada decidua* Forsk. Fl. Aeg.-Arab. (1775) 81.—*C. aphylla* Roth. Nov. Pl. Sp. (1821) 238.—*C. sodada* R. Br. in Desch. Trav. 255; Boiss. Fl. Or. i (1867) 419.
Vernacular name: Kirra (Pu.); Karil (Hind.).
Locality: *N.W.*: Spinwam (Stewart).—Shewa Post, bed of Kuram River (B. & F. 948 !).
S.W.: Zam Valley N.-W. of Tank (Stewart).—Jandola, open stony plain and nalas, 2,200 ft. (F. 691 ! 697 ! 4101 ! 4102 ! 4125 !).—Sarwekai, stony ground, 3,200 ft., not very common (F. 3955 ! 3956 !).—Above Khirgi (Stewart).—Palosina (Stewart).
Flowers: April; 5-4-30 (Shewa Post); May.
Fruit: April, May.
Distribution: Upper Egypt, Nubia, Abyssinia, Darfur, Somaliland, Socotra, Central and S. Arabia, Persia, Baluchistan, Punjab, Sind, Deccan, Gujarat to Tuticorin.

Capparis spinosa L. Sp. Pl. (1753) 503; Boiss. Fl. Or. i (1867) 420.
Vernacular name: Katmavae (Waziri); Kamarkuniae (Bettani).
Locality: *N.W.*: Dwa Warkha (Stewart).—Khajuri Post, left bank of Sua Algad, 2,400 ft. (B. & F. 379 !).—Miram Shah, overhanging rocks (F. 978 ! 979 ! 980 !).
S.W.: Near Palosina (Stewart).—Sarwekai, along stony slopes of Tank River 3,300 ft. (F. 3653 ! 3995 !).—Jandola (F. 252 !).
In bud: 26-3-30 (Khajuri Post).
Flowers: April 1860 (Palosina).
Distribution: Mediterranean region, Arabia, Mesopotamia, Persia, Afghanistan, Baluchistan, Kuram Valley, Punjab, Australia.

Capparis galeata Fres. in Mus. Senckenb. ii, 111.—*C. spinosa var. galeata* Hook. f. & Th. in Hook. f. Fl. Brit. Ind. i (1875) 173.
Vernacular name: Buthiuane (Waziri).
Locality: *N.W.*: Khajuri Post, left bank of Sua Algad, 2,450 ft. (B. & F. 378 !).—E. of Spinwam Fort, on hill (B. & F. 766 !).
S.W.: Jandola, along Tank River (F. 743 !).
In bud: 3-4-30 (Spinwam).
Distribution: Persian Baluchistan, Arabia, E. Africa near the sea.

RESEDACEAE.

60 species.—Chiefly Mediterranean, also in Europe, Asia, S. Africa, California.

Reseda Tourn. ex L.

55 species.—Mediterranean, Europe.

Reseda bracteata Boiss. Diagn. 1, vi, 22, Fl. Or. i (1867) 433.
Locality: *S.W.*: Dargai Post, on slopes of hills (F. 3729 ! 3730 ! 3734 ! 3748 ! 3769 !).
Flowers & Fruit: 22-6-27 (Dargai Post).
Distribution: Mesopotamia, Persia, Afghanistan, Baluchistan.

Reseda pruinosa Del. Ill. Fl. d'Eg. (1813) 15; Boiss. Fl. Or. i (1867) 433.
Locality: *N.W.*: Khajuri Kach, 2,500 ft. (Duthie's Collect. 15739 !).
S.W.: Dargai Post, hillsides (F. 4069 ! 4083 !).—Sarwekai, hillsides, 4,000 ft. (F. 3931 ! 3932 ! 3941 !).
Tank: Near Tank (J. Williams !).
Flowers & Fruit: 22-5-1895; June; 7-6-27 (Sarwekai); 22-6-27 (Dargai Post).
Distribution: Tropical Africa, Egypt, Arabia, Punjab, Sind.

Reseda Aucheri Boiss. Diagn. ser. 1, i (1842) 5, Fl. Or. i (1867) 434.
Locality: *N.W.*: Miram Shah village, bed of Tochi River, on gravel and sand (B. & F. 476 ! 494 !).
S.W.: Sarwekai, hillsides, 3,200 ft. (F. 3925 ! 3929 ! 3930 ! 3949 !).
Flowers & Fruit: 28-3-30 (Miram Shah); June; 7-6-27 (Sarwekai).
Distribution: Asia Minor, Mesopotamia, Persia, Afghanistan, Baluchistan, Sind.

Reseda? Bungei Boiss. Fl. Or. i (1867) 433.
Note.—Boissier says of *Reseda Bungei* that it can be distinguished '*ab omnibus speciebus Orientalibus agminis petalis tantum 2-3 partitis.*' It is for this reason that we put our specimen under Boissier's species, but we cannot be quite sure as we have not seen the fruit.
Locality: *S.W.*: Tenai Post, on stony ground, 3,200 ft. (F. 4058 !).
Flowers: 21-6-27 (Tenai Post).
Distribution: Persia.

***Reseda odorata** L. Sp. Pl. (1753) 646.
Vernacular name: Mignonette.
Locality: *N.W.*: Miram Shah, in garden (B. & F. 628 !).
Flowers: March, April (Miram Shah).
Distribution: Origin unknown. Cultivated everywhere.

Reseda sp.
Vernacular name: Makdanai (Waziri).
Locality: *S.W.*: Razmak, in dry torrent beds and slopes, 6,500 ft. (F. 1987 ! 2004 !).

OLIGOMERIS Cambess.

5 species.—Africa, India. S.-W. United States.

Oligomeris sutulata Boiss. Fl. Or. i (1867) 435; Blatter Fl. Arab. pt. i (1919) 48.—*Reseda subulata* Del. Ill. Fl. d'Eg. no. 464.—*Oligomeris glaucescens* Camb. in Jacq. Voy. Ind. iv, 24, t. 25.
Vernacular name: Hurmly.
Locality: *N.W.*: Razani (Stewart).—Near Miram Shah, bed of Chasmai River, 3,100 ft. (B. & F. 311 !).—Khajuri Post, sandy clay (B. & F. 423 !).
Tank (J. Williams 7112 ! 7197 !).
Flowers & Fruit: 24-3-30 (Miram Shah); 5-5-1888 (Tank).
Distribution: N. Africa, Arabia, Persia, Afghanistan, Baluchistan, Sind, Western N. America.

VIOLACEAE.

300 species.—Cosmopolitan.

VIOLA Tourn. ex L.

250 species.—Cosmopolitan, chiefly N. temperate.

Viola serpens Wall. in Roxb. Fl. Ind. Ed. Wall. ii, 449.
Vernacular name: Khojhakai (Waziri).
Locality: *S.W.*: Razmak, 6,500 ft. (F. 3151 !).—Pre Ghal (Duthie's Collect. 15797 !, J. Williams 7773 !).
Flowers: 16-5-1895 and 2-8-1888 (Pre Ghal).
Distribution: Kuram Valley, Punjab, throughout the temperate Himalaya, Khasia Hills, Nilgiris, Ceylon, Java, China.

Viola sylvatica Fries Mant. iv, 121; Boiss. Fl. Or. i (1867) 459.
Vernacular name: Yuvrie (Waziri).
Locality: *N.W.*: Razani, 5,000 ft. (F. 2923 ! 2926 !).
S.W.: Razmak, 6,500 ft. (F. 1623 ! 1800 ! 3130 !).
Flowers: April, May.
Distribution: All over Europe, Transcaucasus, Persia, N. Asia.

Viola canina L. Sp. Pl. 935; Boiss. Fl. Or. i (1867) 459.
Locality: *N.W.*: Razani, 5,000 ft. (F. 2616 ! 2922 !).
S.W.: Razmak, 6,500 ft. (F. 1579 !).
Flowers: April.
Distribution: All over Europe, Caucasus, Siberia.

Viola oblonga Blatter in Journ. Ind. Bot. Soc. ix (1930) 200.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 2017 ! 1550 ! 2332 !).
Flowers & Fruit: April.
Distribution: Endemic.

***Viola tricolor** L. Sp. Pl. 935.
Vernacular name: Pansy, Heartsease.
Locality: *S.W.*: Razmak, in garden (B. & F. !)
Flowers: April.
Distribution: Europe.

Viola sp.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 3202 !).

POLYGALACEAE.

700 species.—Cosmopolitan, except New Zealand, Polynesia and Arctic Zone.

POLYGALA (Tourn.) L.

475 species.—Distribution of family.

Polygala persicariaefolia DC. Prodr. i (1824) 326.
Vernacular name: Khotjakai (Waziri).

Locality: *S.W.*: Razmak (F. 3118 !).
Flowers & Fruit: 5-5-27 (Razmak).
Distribution: India, temperate and subtropical Himalaya, 5,000-9,000 ft., Yunnan, Siam, Philippines, New Guinea, Australia, tropical Africa.

Polygala Hohenackeriana F. & M.. Ind. Sem. Hort. Petrop. iv, 42.
Locality: *N.W.*: Miram Shah, 3,000 ft. (F. 396 ! 408 ! 411 ! 414 !).—On gravel of left bank of Volam River below Shewa Post (B. & F. 880 !).—Loargai Narai (B. & F. 1327 !).—Dossali Fort stony plain, 4,900 ft. (B. & F. 985 ! 1281 !).—Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 648 ! 748 !).
S.W.: Barwand, 4,000 ft. (Duthie's Collect. 15703 !).
Tank: Near Tank (J. Williams !).
Flowers: April (Miram Shah, Barwand); 16-4-30 (Loargai); May (Tank).
Fruit: April, 5-4-30 (Shewa Post); 16-4-30 (Loargai).
Distribution: Persia, Afghanistan, Caucasus, Kuram Valley, Baluchistan, Punjab.

Polygala sibirica L. Sp. Pl. 702.—*P. elegans* Wall. Cat. 4186.
Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15600 !).—Near Kaniguram brook (Stewart).
Flowers: 17-5-1895 (Pre Ghal).
Distribution: Afghanistan, tropical and subtropical Himalaya, Khasia Hills, Nilgiris, Ceylon, China, Japan, Siberia.

PORTULACACEAE.

225 species.—Cosmopolitan, but especially American.

PORTULACA L.

20 species.—Tropical and subtropical.

Portulaca quadrifida L. Mant. (1767) 73.
Vernacular name: Zhinai (Waziri); Perkhadai (Bettani).
Locality: *N.W.*: On slope of hills E. of Miram Shah Fort, 3,600 ft. (B. & F. 568a ! 571 !).—In bed of Volam River at Shewa Post (B. & F. 889 !).—On limestone hill N. of Spinwam Fort, 2,650 ft. (B. & F. 811 !).—E. of Spinwam Fort in sandstone nala (B. & F. 671 !).
S.W.: Palosina (Stewart).—Jandola (F. 275 !), W. of Fort, along Tank River (F. 739 !).
Flowers: April 1860 (Palosina).
Distribution: Tropical Asia and Africa.

TAMARICACEAE.

100 species.—Temperate and subtropical. Desert, shore and steppe plants.

TAMARIX L.

65 species.—Europe, Mediterranean, Asia.

Tamarix aphylla Lanza in Boll. Orto. Bot. Pal. viii (1909) 82.—*T. articulata* Vahl. Symb. ii (1791) 48, t. 32.—*Thuya aphylla* L. Cent. Pl. i, 32.
Vernacular name: Khugal (Williams).
Locality: *N.W.*: Boya, bed of Tochi River, 3,550 ft. (B. & F. 102 !).—Miram Shah Fort, planted in avenue, 3,150 ft. (B. & F. 750a !).—Miram Shah village, bed of Tochi River, gravel and sand (B. & F. 497 !).—Miram Shah, bed of Chasmai River, gravel and sand, 3,100 ft. (B. & F. 255 !).—Khajuri Post, bed of Tochi River, 2,250 ft. (B. & F. 421 !).—E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 658 !).—Shewa Post, bed of Volam River (B. & F. 867 !).
S.W.: Tenai Post, along stream (F. 2820 !)..—Sararogha, along Tank River (F. 230 ! 234 !).—Jandola, along Tank River (F. 698 !).
Tank (J. Williams 7778 !).
Distribution: Sind, Baluchistan, Cutch, Mt. Abu, Punjab, Arabia, Algeria, S. Africa.

Tamarix dioica Roxb. Hort. Beng. (1814) 22.
Vernacular name: Khwa (Pushtu); Lai, Pilchi (Punjabi); Jhau (Hind.); Ghuz (Pers.).
Locality: *S.W.*: Sararogha (F. 219 !), along shingle and sandy bed of Tank River (F. 230a !).—Dargai Post (F. 3745 !).
Tank: Common as jungle (Stewart).
Flowers: 22-6-27 (Dargai).
Distribution: Afghanistan, Sind, Gujarat, Assam, Burma.

Tamarix Troupii Hole Ind. For. xlv, 247.
Locality: *N.W.*: Khajuri Post, bed of Tochi River (B. & F. 417 !).
S.W.: Dargai Post, marsh (F. 3739 ! 3774 !).
Distribution: Sind, Baluchistan, Punjab, United Provinces.
Uses: Browsed by animals.

Tamarix stricta Boiss. Diag. ser. 2, fasc. 2 (1856) 57.
Locality: *N.W.*: Shewa Post, torrent bed, forms extensive and almost pure formations (B. & F. 956 !).
S.W.: From Tenai to Spin, along stream (F. 3822 ! 4013 ! 4016 !).
Flowers & Fruit: 21-6-27 (Tenai to Spin).
Distribution: Sind, Baluchistan.

(*To be continued*).

FISH OF AFGHANISTAN.

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(*With a map, a plate and 2 text-figures*).

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INTRODUCTION.

With the exception of inadequate and highly confusing descriptions of certain species collected by Griffith and reported by McClelland[1] in 1842, very little is known about the ichthyology of Afghanistan. It is a matter of great pleasure, therefore, to be in a position to report, after a lapse of about 90 years, on a collection of fishes from this region. This happy result is due to the persistent efforts of Mr. S. H. Prater, Curator of the Bombay Natural History Society, who, at my suggestion, interested the members of the British Embassy at the Court of Afghanistan to make a collection of fish in the Kabul River and the adjoining provinces. In 1931, a specimen of the trout, '*Salmo orientalis* McClelland', was received from Sir Richard Maconachie, and in September 1932 the Bombay Natural History Society received a fine lot of four specimens collected at Paghman in the Paghman River by the Military Attaché, British Legation, Kabul. The interest of these collections lies in the fact that they enable us to understand the systematic position and the specific limits of certain fish described by McClelland. Griffith made extensive collections and it is not likely, therefore, that many new forms will be discovered in Afghanistan, especially in the regions traversed by him. Unfortunately, a part of his collection was either lost or badly damaged in transit, and, consequently, the material in McClelland's hands was not very trustworthy and a number of new species were described from drawings only. It is to be regretted that McClelland's reproductions of these illustrations are very poor, and that the whereabouts of the originals is

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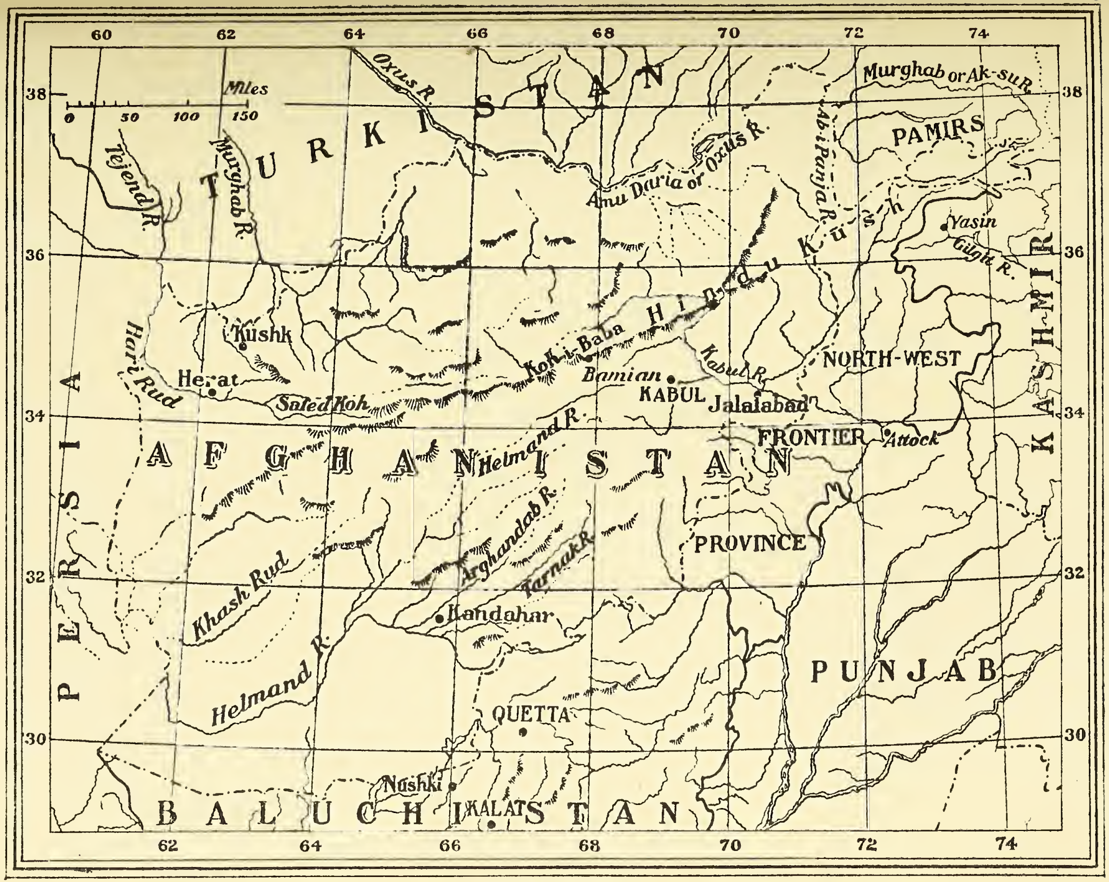
[1] McClelland, *Calcutta Journ. Nat. Hist.*, II, pp. 575-586 (1842).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100
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PERSIA
TURKISTAN
AFGHANISTAN
BALUCHISTAN
PAMIRS
KASHMIR
NORTH-WEST
FRONTIER
PROVINCE
PUNJAB
Oxus R.
Murghab or Ak-su R.
Ab-i-Panja R.
Amu Daria or Oxus R.
Tejend R.
Murghab R.
Hindu Kush
Yasin
Gilgit R.
Kushk
Hari Rud
Herat
Safed Koh
Koh-i-Baba
Bamian
KABUL
Kabul R.
Jalalabad
Attock
Helmand R.
Arghandab R.
Tarnak R.
Khash Rud
Kandahar
Helmand R.
QUETTA
Nushki
KALAT

AFGHANISTAN

Map of Afghanistan and the neighbouring country showing the position of the various places, rivers and mountains referred to in the text. Modified from the map in the *Imperial Gazetteer of India*, v, p. 64 (1908).

Note.—Broken line indicates the boundary of Afghanistan.

not known. Since Griffith's time the ichthyology of Central Asia has received considerable attention, and the names given by McClelland to Afghanistan fishes are being used for species known from widely separated localities. A very wide interpretation is being given to McClelland's species in view of the fact that, in most cases, his descriptions and figures have nothing specific about them, and that they are equally applicable to a number of species. The five specimens of fish received from Afghanistan have helped to clear up highly controversial points regarding the taxonomy and provenance of certain genera and species, and it is confidently to be hoped that further collections from Afghanistan will be made available before long for the proper understanding of the ichthyology of the country. I take this opportunity to extend my warmest thanks to all those who have put me in a position to report on the fish of Afghanistan, and to direct the attention of likely collectors to the nature of the material to be looked for and the localities that should be thoroughly investigated.

Physical Features of Afghanistan.

'Afghanistan is a long, oval-shaped country, stretching through 700 miles, narrowing to a point on the north-east, where an arm is extended outwards to the Pamirs. Right across it, from west to east (but curving upwards to touch this extended arm at its eastern extremity), is a band of mountains, which separates the basin of the Oxus on the north from that of the Indus and the Helmand on the south, but which still leaves space for a river (the Hari Rud, or River of Herat) to form a basin of its own on the north-west.'[1] Afghanistan lies between 29°23' and 38°31' N. and 60°45' and 72°0' E., with a long narrow strip extending to 74°55'E.; and its total area is estimated to be 246,000 square miles.

There are three main river basins in Afghanistan: namely, those of the Oxus, the Helmand, and the Kabul. 'With the Oxus basin may be included those of the Murghab and the Hari Rud, though neither of these rivers finds its way to the Oxus, both being lost in the great desert lying to the north-west of Afghanistan, the former near Merv and the latter in the Tejend Oasis.'[2]

'The Oxus basin occupies the whole breadth of Northern Afghanistan from east to west. With its affluents it drains the Western Pamirs; and its southern watershed is defined by the Hindu Kush; the Koh-i-Baba, and the Band-i-Baian, which separate it from the basins of the Kabul and Helmand.' The Oxus empties itself in the Aral Sea. 'The Helmand (*Etymander*) river with its tributaries, drains all the south-western portion of Afghanistan. It rises in the Western slopes of the Paghman range, between Kabul and Bamian, and flows in a south-westerly direction through the Hazarajat, being joined about 35 miles south-west of Girishk by three great tributaries, the Arghandab, the Tarnak, and the Arghastan. . . . The basin of Kabul river is divided from that of Helmand by the Paghman range, an offshoot of the Hindu Kush. This river rises about 40 miles west of Kabul city, near the Unai pass, and flows in a general easterly direction to Dakka, where it turns northwards, forming a loop enclosing much of the Mohmand country. It then turns east and south again, and eventually joins the Indus at Attock'.

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[1] Holdich, *Society of Arts Journal* of March 11, 1904.

[2] Clarke, *Imperial Gazetteer of India*, V, p. 29 (1908).

HISTORICAL SKETCH.

In the years 1836-38, Lieut.-Col. Sir Alexander Burnes was sent on a mission to Kabul, and in the party that accompanied him Dr. P. B. Lord acted as Naturalist in addition to his other duties. In sending the mission, 'The objects of Government were to work out its policy of opening the river Indus to commerce, and establishing on its banks, and in the countries beyond it, such relations as should contribute to the desired end.'[1] In pursuance of this policy the mission went all the way up by river as far as Attock, thence to Peshawar and from there over the Khyber Pass to Kabul. During this journey drawings of animals were made and about '200 specimens of natural history' were collected. The drawings with a letterpress by Dr. Lord and the specimens were presented by the Supreme Government to the Asiatic Society of Bengal in September 1838, and it was once the intention of the Society to publish coloured lithographed copies of these zoological sketches. I have indicated elsewhere[2] how, after spending nearly six thousand rupees, the Society gave up its intention in 1847 by not issuing even the printed copies of these illustrations. A very careful search of the rooms of the Society has not revealed the existence of any published copies of this work.

In Burnes' collection of drawings there are illustrations of 32 species of fish, but only two of these are stated to have been collected in the Kabul River. Of these two, one is said to be common to 'River of Cabool and Attock'. Unfortunately the precise locality of these two species is not indicated, though in nearly all other cases the names of towns are mentioned. It is not certain, therefore, whether any fish was collected in Afghanistan or not, as the species stated to have been collected in the Kabul River may have been obtained outside the geographical limits of that country. As many as 29 species of fish figured in this collection are those that are commonly found in the plains of India, while *Orcinus sinuatus*, (probably *O. plagiostomus*, pl. vi MS), *Schizothorax labiatus* (pl. vii MS) and *Schizothorax esocinus* (pl. vii Ms) are typically Central Asiatic forms, which are known to occur in the Kabul River and its tributaries much higher up. It is interesting to note that both the species of *Schizothorax* are said to have been found at Attock. According to Burnes the rivers of Afghanistan are 'well stored with fish' and Ghoorbund, Purwan and Punjsheer, are rapid brooks with stony beds. In winter they can be easily forded, while in spring and summer they are much swollen. These streams unite and 20 miles from Kabul near Tungi Gharoi there is a waterfall. 'It is one of the great amusements of the people to ensnare the fish as they leap up this cascade.'[1] Afghans, as a rule, are not good collectors of zoological specimens, and fish, of which their rivers are said to be heavily stocked, does not form an important article of their diet.

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[1] Burnes, *Cabool* (London: 1842).

[2] Hora, *Journ. As. Soc. Bengal* (n.s.), xxii, pp. 117-125 (1926).

The ichthyology of Afghanistan was made known for the first time through the researches of Mr. William Griffith, who seems to have possessed a considerable knowledge of the freshwater fishes of India. Griffith entered Afghanistan through the Bolan pass and studied the fishes of the Helmand system, and from there he went to the Oxus system on the northern slope of the Hindu Kush. The fishes of the Kabul River were next investigated and then on his way back to India he studied the fish of the streams in the Khyber Pass. It is thus seen that Griffith made collections in all the three principal river systems of Afghanistan. Griffith's own remarks on these collections are included in the introductory part of McClelland's account, and they give a very good general idea of the fish-fauna of Afghanistan. A perusal of this account leaves an impression that there are many species of fish, which were observed by Griffith but have not been reported by McClelland probably through lack of material. In all McClelland records 20 species of fish from Afghanistan, of which 5 represent the Indian element in the fauna, the remaining 15 being typically Central Asiatic. Of these 15 species, 2 occur in the Oxus basin, 5 in the Helmand basin and as many as 11 in the Kabul basin. These species may be listed below as follows:—

Oxus System.

1. *Racoma gobiodies* McClell.	Bamean River.
2. *Salmo orientalis* McClell.	Northern declivities of the Hindu Kush, and Bamean River.

Helmand System.

1. *Racoma brevis* McClell.	Helmand River.
2. *Schizothorax esocinus* Heck.	Tributaries of the Helmand and Kabul rivers.
3. *Schizothorax intermedius* McClell.	Tarnak River and Kabul River at Jalalabad.
4. *Schizothorax ritchieana* McClell.	A variety with the small dorsal spine in the Helmand River.
5. *Oreinus plagiostomus* Heck.	Helmand River at Girdun Dewar.

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[1] Burnes, *Cabool*, p. 154 (London; 1842).

Kabul System.

a. Central Asiatic forms.

1. *Racoma chrysochlora* McClell.	'Lolpore'.
2. *Racoma nobilis* McClell.	?
3. *Racoma labiatus* McClell.	Pashat, Kunar River.
4. *Schizothorax esocinus* McClell.	Tributaries of the Helmand and the Kabul rivers.
5. *Schizothorax intermedius* McClell.	Kabul River at Jalalabad and Tarnak River.
6. *Schizothorax edeniana* McClell.	Koti-i-Ashraf, Mydan Valley and Sir-i-Chushmah.
7. *Schizothorax ritchieana* McClell.	Afghanistan. A variety in the Helmand.
8. *Schizothorax barbatus* McClell.	Jalalabad.
9. *Oreinus maculatus* McClell.	Gandamak, Khyber Pass, Himalaya.
10. *Oreinus griffithii* McClell.	Pashat, Kunar River.
11. *Glyptosternum reticulatum* McClell.	Sir-i-Chushmah, Kabul River.

b. Species allied to Indian fauna.

1. *Cirrhinus burnesiana* McClell.	Jalalabad.
2. *Opsarus bicirratus* McClell.	Jalalabad, Khyber Pass.
3. *Ophiocephalus montanus* McClell.	'Baisoot, Jalalabad, Himalaya and Sadoo.'
4. *Silurus indicus* McClell.	'Loodianah, the Punjab, and the Cabool river at Jalalabad.'
5. *Pimelodus anisurus* McClell.	'Loodianah and Cabool river at Jalalabad.'

In the above list the names given by McClelland to the various species are used, and till we become more familiar with the Afghanistan fishes it may be advisable to refer to the species by these names. The above list shows that there are 3 species that are common to the Kabul and the Helmand river systems. The sources of these rivers are not very far apart, and it is not unlikely, therefore, that several other common species may be discovered later on. The second point of interest is that Jalalabad forms the furthest limit to the north-west to which the species of India extend. We have already seen from Burnes' collection of drawings that Attock is the limit to which the Central Asiatic species of the Kabul River extend downwards to the south-east.

In 1880, Day[1] wrote an article on the 'Fishes of Afghanistan', but a perusal of the paper shows that his material was collected in the highland of Kelat and Quetta, and from Gwadur on the Mekran coast. These places once formed part of Afghanistan, but are now included in Baluchistan. Day's account applies to the fish of 'a range of hills stretching from the valley of the Indus, their utmost southern point being near Kurrachee; and in their course they divide Sind from Baluchistan.' As is to be expected, the major portion of the fish-fauna of this tract is similar to the Indian fauna. The genus *Scaphiodon* is characteristic of Baluchistan, though one species is found in the Salt Range,[2] Punjab, and three others in the Nilgiris in South India.[3] The fauna of Baluchistan, on the whole, has little affinity with the Central Asiatic fauna, and, therefore, with the typical fauna of Afghanistan.

Dr. J. E. T. Aitchison, when attached to the Afghan Delimitation Commission, made a collection of Zoological specimens along the southern, western and north-western boundaries of Afghanistan. The fish collection was reported on by Günther,[4] and the following species[5] were recorded:—

1. *Cirrhina afghana* Günther.	Nushki and Kushk.
2. *Discognathus lamta* (H.B.).	Helmand River and Kushk.
3. *Capoeta steindachneri* Kessler.	Nushki and Kushk.
4. *Schizothorax intermedius* McClell.	Kushk.
5. *Schizothorax raulinsii* Günther.	Hari Rud River near Khusan, Bezd, Jam River.
6. *Gobio gobio* Linn.	Kushk.
7. *Nemachilus kessleri* Günther.	Nushki.

This collection reveals for the first time the nature of the fish-fauna of the Murghab River basin, and it is a matter of great surprise that a member of the common Indian genus *Cirrhina* should have been found as far afield as Kushk. It is equally interesting to notice the occurrence of *Capoeta* at Nushki. The fish-fauna of the Murghab River possesses affinities with that of Western Turkestan, Persia and eastern portion of the Central Asiatic region. The fauna of the Hari-rud contains an endemic species of *Schizothorax*, which is a typically Central Asiatic genus.

The fauna of Seistan is known from two collections one made by Sir Henry McMahon and other officers of the Seistan Arbitration Commission of 1902-1904, and the other by officers of the

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[1] Day, *Proc. Zool. Soc., London*, pp. 223-232 (1880).

[2] Hora, *Rec. Ind. Mus., XXV*, pp. 379-382 (1923).

[3] Day, *Fish. India*, pp. 551, 552 (1877).

[4] Günther, *Trans. Linn. Soc., London* (2) V, pp. 106-109 (1889).

[5] After a perusal of an advance typed copy of this article, Prof. L. S. Berg has discussed the specific limits of the species obtained by the Afghan Delimitation Commission in a short article (*Rec. Ind. Mus.*, XXXV, pp. 193-196, 1933).

Zoological Survey of India in the winter of 1918. The study of these collections has shown that in Seistan there are representatives of 9 species of fish,[1] which are listed below:—

1. *Scaphiodon macmahoni* Regan.	Delta of the Helmand.
2. *Garra adiscus* (Annandale).	Nasratabad and Hamun-i-Helmand.
3. *Garra phryne* (Annandale).	Quetta and Pishin districts of Baluchistan, Hamun and delta of the Helmand.
4. *Schizothorax zarudnyi* (Nikolsky).	Hamun-i-Helmand.
5. *Schizopygopsis stoliczkae* Steind.	Delta of the Helmand. Headwaters of streams and rivers on the north side of the Himalayas and Hindu Kush.
6. *Schizocypris brucei* Regan.	Waziristan, streams in the neighbourhood of Nasratabad.
7. *Nemachilus tenuis* Day.	Kushk, Rud-i-Seistan, Oxus river system.
8. *Adiposia macmahoni* (Chaud.).	Delta of the Helmand, streams near Nasratabad.
9. *Adiposia rhadinaea* (Regan).	Delta of the Helmand.

The fishes listed above may be separated as a whole into two geographical divisions. 'The Cyprinidae, which do not occur in the highlands of Central Asia, represent an element derived from the country lying south and south-east of the Helmand basin; while the Schizothoracinae and the Cobitidae have been brought by the Helmand from the Hindu Kush and are probably descended from the fish-fauna of the ancient and once extensive Oxus system.' We have already noted above that some of the species are common to the Helmand and the Kabul basins.

Major G. E. Bruce made a small collection of fish in the Wana Toi, a tributary of the Gomal river in Southern Waziristan. Regan,[2] who reported on this collection, found six species in it, *viz.*, *Callichrous pabda* (H. B.), *Barilius vagra* (H. B.), *Scaphiodon irregularis* Day, *Crossocheilus barbatulus* Heckel, *Garra wanae* Regan and *Schizocypris brucei* Regan. With the exception of the last species, all the others are allied to Indian forms. *Schizocypris* represents the Central Asiatic element in this fauna, which is mainly a mixture of the Indian and Baluchistan forms.

The fish-fauna of Persia is scanty and has very little affinity with that of Afghanistan. The fishes of South Persia are remarkably similar to those of Sind and Baluchistan. The fishes of

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[1] Annandale and Hora, *Rec. Ind. Mus.*, XVIII, pp. 151-191 (1920).

[2] Regan, *Ann. Mag. Nat. Hist.* (8), XIII, pp. 261-263 (1914).

Western Turkestan[1] are mainly those that have descended from the north or those that have populated the country from the east or west. There is also a certain amount of a Central Asiatic element in this fauna. A species of *Salmo* is found in Western Turkestan, as well as in the rivers on the northern slopes of the Hindu Kush in Afghanistan. On the whole the fauna of Western Turkestan is quite distinct from that of Afghanistan.

The fishes of the countries lying along the north-eastern boundary of Afghanistan are better known. My colleague, Dr. B. N. Chopra, made a large collection of fish in the Chitral Valley from which waters drain into the Kabul River near Jalalabad. There seem to be representatives of five species in this collection, and all of these are typically Central Asiatic and have been recorded by Griffith from Afghanistan. The species belong to the genera *Glyptosternum*, *Nemachilus*, *Schizothorax* and *Oreinus*. The fishes of the Pamirs are known to us from the collection made by Alcock as member of the Pamir Boundary Commission, 1895. In a general way, the Pamirs are simply the broad alluvial valleys of the Aksu and the Ab-i-Panja rivers. On the Pamirs only four species of fish were found, *viz.*, *Schizothorax fedschenkoi* Kess., *Schizopygopsis stoliczkae* Steind., *Schizopygopsis sewerzowi* Herz. and *Nemachilus tenuis* Day. Though the number of species is small, it was observed by Alcock[2] that 'Fishes, all of the Carp family, were numerous in every stream and pool, both adults and fry, the commonest being *Schizopygopsis stoliczkae*. It must be either this fish, or a *Schizothorax* which I identify as *S. fedschenkoi*, that travellers in this region have spoken of as "trout". That fishes are so abundant is probably due to the fact that they have few enemies, and that food, in the form of water-snails and larvae of chironomid flies, is plentiful. *Schizopygopsis* would generally take the small fly-spoon, and *Schizothorax* was best caught with a sunk bait of raw meat'. In describing the fishes of the Pamir Expedition 1928, Berg[3] records the same four species which were collected by Alcock. The fauna of this tableland is thus seen to be limited as regards the number of species. On his way to the Pamirs, Alcock collected fishes in the Yasin river and obtained the following species of fish:—*Schizothorax nasus* Heck., *Schizothorax hodgsonii* Günth., *Ptychobarbus conirostris* Steind., *Nemachilus stoliczkae* (Steind.) and *Nemachilus yasinensis* Alcock. All the species are known to be fairly common in Kashmir and the Himalayas. The fish-fauna of Kashmir, with the exception of the few Indian genera that are found in the valley, consists of the *Schizothoracinae* (several genera), *Cobitidae* (*Nemachilus*) and *Sisoridae* (*Glyptosternum*).

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[1] Kessler, 'Pisces' in Fedtschenko's *Reise in Turkestan* (1874).

[2] Alcock, *Report of the Natural History of the Pamir Boundary Commission*, pp. 67-68, 91-92 (1896).

[3] Berg., 'Pisces' in *Abandlungen der Pamir Expedition*, 1928, VIII, pp. 23-28 (1932).

From the above sketch of the ichthyology of Afghanistan and of the countries in its immediate neighbourhood, it is clear that Afghanistan forms an important region from a zoo-geographical point of view. The Hindu Kush forms the southernmost limit (leaving out of consideration the *Salmonidae* introduced in India) of the *Salmonidae* and of several other kinds of fish characteristic of Turkestan, and of the countries lying to north, east and west of it. The typical fishes of Sind, Baluchistan and Persia have no representatives in Afghanistan, and the Indian element in its fauna does not extend beyond Jalalabad. The affinities of the Afghanistan fish-fauna have to be looked for in the fauna of the countries lying to the north-east of it. The *Schizothoracinae*, so characteristic of the Tibetan Plateau, seem to have spread into Afghanistan from the north-east, and extended their range to the south-west as far as Seistan, the basins of the Hari Rud and the Marghab Rivers, and other water courses in the west and north-west of Afghanistan. The physical features of Afghanistan are such that they appear to form natural barriers in connection with the geographical distribution of fishes. The extension of the Central Asiatic forms into Afghanistan may have taken place when the Oxus basin was very extensive.

DESCRIPTION OF THE COLLECTION.

a. A small collection of fish from the Paghman River.

The following description of the Paghman River has been supplied by the Secretary, British Legation, Kabul:—'The Paghman stream is a hill torrent which rises in the Paghman range, and runs past Paghman, about fifteen miles from Kabul. When in flood this stream probably joins the Kabul river, near Kabul City, but in normal times nearly all its water is taken off for irrigation, and what little is left disappears underground. The stream bed is rocky and there is practically no vegetation in it. The current is swift. In late summer and autumn the stream, which is snow fed, dwindles down to a mere trickle'. In August 1932 the Surgeon to the British Legation sent a small collection of fish from the Paghman river to the Bombay Natural History Society. It consisted of 4 specimens, one of *Glyptosternum*, two of *Nemachilus* and one of *Oreinus*. The two specimens of *Nemachilus* appear to belong to *N. griffithii* Günther, though on account of their small size they exhibit important differences from the type-specimens preserved in the British Museum (Nat. Hist.). A complete description of the specimens is given below. *Glyptosternum reticulatum*, though originally described from the Kabul River, is now known to be widely distributed in the headwaters of the Indus and of Amu-Darya and the Syr-Darya in Western Turkestan. The young specimen of *Oreinus* appears to belong to *O. sinuatus* var. *griffithii* McClelland. The systematic position of the last two forms has not been properly understood so far.

Glyptosternum reticulatum McClelland.

1842. *Glyptosternon reticulatus*, McClelland, *Calcutta Journ. Nat. Hist.*, II, p. 584.
1876. *Exostoma stoliczkae*, Day, *Proc. Zool. Soc. London*, p. 782.
1905. *Parexostoma stoliczkae*, Regan, *Ann. Mag. Nat. Hist.* (7), XV, p. 183,
1932. *Glyptosternum reticulatum*, Hora, *Ann. Mag. Nat. Hist.* (10), X, pp. 176-179.
1932. *Glyptosternum reticulatum*, Hora, *Current Sci.*, I, p. 130.

The single specimen of *Glyptosternum reticulatum* is about 5 inches in length, and is in a fairly good state of preservation. The species was originally described from 'Sir-i-Chushma, at the source of the Kabul river'. Griffith in his notes no doubt refers to this fish when he says that in the small channels by which the springs at Sir-i-Chushmah run off: 'The most remarkable fish however is a dark coloured Loach-like Silurus, which is not uncommon about Julraiz'. *G. reticulatum* was insufficiently characterized by McClelland, and has been the source of considerable confusion in the taxonomy of certain Sisorid fishes. After an examination of a very large collection of this species from the Chitral river, it was pointed out by me that *Parexostoma stoliczkae* (Day) is probably a synonym of *G. reticulatum* McClelland. The discovery of a specimen of this species from a stream near Kabul leaves no doubt whatsoever about the systematic position and specific limits of McClelland's much-discussed species. With this knowledge, it will now be possible to apply the generic names *Glyptosternum*, *Glyptothorax*, *Exostoma*, etc., in terms of the International Rules of Zoological Nomenclature.

G. reticulatum is found in the headwaters of the Indus and in Eastern and Western Turkestan.

Nemachilus griffithii Günther.

(Plate, figs. 1 and 2).

D. 2/7; A. 2/5; P. 10; V. 8; C. 16, besides smaller rays at the sides.

The two specimens of *Nemachilus griffithii* are long and narrow with the head markedly pointed anteriorly and the body tapering gradually towards the posterior end. The opercular region of the head is very prominent. The head and the part of the body in front of the ventrals are somewhat depressed and flattish both on the dorsal as well as on the ventral surfaces. The length of the head is contained 5 to 5.1 times in the total length with the caudal and 4.1 to 4.2 times in the length without the caudal. The height of the head at occiput is contained 1.7 to 1.8 times in the length of the head, while its width is contained 1.3 times in its length. The eyes are small, dorso-lateral in position and are not visible from the ventral surface; the diameter of the eye is contained 5 to 6 times in the length of the head, 2.2 to 2.6 times in the length of the snout and 1.4 to 1.5 times in the interorbital width. The snout is somewhat longer than the postorbital part of the head. The nostrils are situated immediately in front of the eyes; the posterior nares are well-marked, while the anterior ones are small and tubular and are situated at the bases of broad and triangular processes which cover them completely and hide them from view. The mouth is small, lunate and subterminal. The lips are fleshy and continuous at the angles of the mouth; the lower lip is interrupted in the middle. The upper jaw forms a vertical plate which is convex at its free end; the lower jaw is sharp and shovel-like. When the mouth is closed the upper jaw lies in front of the lower jaw. The barbels are thin and long; the outer rostral and the maxillary barbels are subequal, being almost as long as the snout. The inner rostral barbel is much shorter.

The body is devoid of scales; it is greatly shrivelled up due to preservation so that its height is difficult to judge, but so far as it can be ascertained the greatest depth of the body is contained 9 times in the total length and 7.3 to 7.4 times in the length without the caudal. The caudal peduncle is compressed from side to side, its least height is contained 2 to 2.2 times in its length. The lateral line is almost complete; it is only irregularly interrupted towards the end.

The commencement of the dorsal fin is almost equidistant between the tip of the snout and the base of the caudal fin; it may be slightly nearer to the latter than to the former. The free end of the dorsal fin is subtruncate with the anterior corner more or less rounded; the dorsal fin commences considerably in advance of the ventral; the second divided ray is the longest and it is as long as the greatest width of the head. The ventral fin is long and narrow: it extends considerably beyond the anal-opening, and is separated from the anal fin by a short distance. The caudal fin is slightly shorter than the head and is preceded, both above and below, by a number of small rays. It is obliquely truncate with the upper portion slightly longer than the lower.

Of the two specimens, the larger one appears to be a male, though the characteristic secondary sexual characters of the male are not well defined in it. There is a shallow groove in front of the eye, but the tubercular pads associated with it are absent. The four outer rays of the pectoral fin, to a certain extent the fifth ray also, are broad, bony and curved, but they lack the tubercular pads on the dorsal surface. Secondary sexual characters of a similar nature are found in the males of *N. brauhi*.

The smaller specimen is more conspicuously marked than the larger one. The latter is greyish above and olivaceous below. The dorsal surface, especially in front of the dorsal, is marked with faint cross bands. The caudal and the dorsal fins are minutely speckled, while the other fins are provided with indistinct marks. In the smaller specimen the body is much darker and 7 short, saddle-shaped bands on the dorsal surface are well marked. The dorsal surface of the head is irrorated with small, black dots; while the caudal, dorsal and pectoral fins are conspicuously marked with irregular black bands formed of series of blotches. The ventral fin is provided with one series of spots across it and the anal fin with two similar series. The inner rostral barbels as well as the tips of the other two pair are deep orange-red in colour.

Measurements in millimetres.

Total length including caudal fin	84.2	99.0
Length of caudal	15.0	18.5
Depth of body	9.3	11.0
Length of head	16.5	19.6
Length of snout	7.4	8.6
Interorbital distance	5.0	4.8
Diameter of eye	3.3	3.3
Height of head at occiput	9.0	11.7
Width of head	12.2	15.0
Length of caudal peduncle	15.5	18.0
Least height of caudal peduncle	7.6	8.0
Longest ray of dorsal	12.3	14.6
Longest ray of anal	10.5	12.0
Length of pectoral	13.2	15.5
Length of ventral	11.0	12.8
Distance between pectoral and ventral fins	12.0	10.0
Distance between commencement of dorsal and tip of snout	35.0	41.0

Remarks. Griffith in his notes says that 'in the small channels by which the springs (at Sir-i-Chaushmah) run off, a loach is very common'. It is quite probable that *Nemachilus griffithii* is the species which was observed to be very common by Griffith at the source of the Kabul River. The only other record of this genus from Afghanistan is, as I have shown elsewhere,[1] from the Arghandab near Kandahar. The type specimens in the British Museum differ from the two specimens described above and these differences may be tabulated below as follows:—

Paghman river specimens.	*Type specimens.*
Length of head 4 times in total length without caudal.	Length of head 5 times in total length without caudal.
Ventral fins extend considerably beyond anal-opening, and almost reach base of anal fin.	Ventral fins just reach anal opening, and are separated from base of anal fin by considerable distance.
Outer rostral barbel as long as snout.	Outer rostral barbel 2/3 length of snout.
Mouth-opening small.	Mouth-opening relatively wider.

In evaluating the above characters it should be borne in mind that the two specimens from the Paghman River are 3.4 and 4 inches in length respectively; while the two type specimens are 'Five and a half inches long'.

According to Griffith the loach of Sir-i-Chushmah is also said to occur 'in the Helmand at Girdun Dewar, altitude 10,500 feet'. We have already seen that a number of species are common to the Helmand and the Kabul basins, and it is likely that *N. griffithii* is fairly widely distributed in Afghanistan.

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[1] Hora, *Journ. As. Soc. Bengal* (n.s.) XXIV, pp. 481-484 (1929).

Oreinus sinuatus var. **griffithii** McClelland.

1842. *Oreinus Griffithii*, McClelland, *Calcutta Journ. Nat. Hist.*, II, p. 581.
1842. *Oreinus maculatus*, McClelland, *ibid.*, p. 580.

Specimens of the genus *Oreinus* seem to have been collected by Griffith from the head of the Ali Musjid stream (Khyber Pass), Gandamak, Pashat and Girdun Dewar. The Helmand river examples (Girdun Dewar) were referred by McClelland to *O. plagiostomus* Heck., while those collected at Pashat (Kunar river) were described as *O. griffithii.* The other specimens from the Ali Musjid stream and Gandamak were referred by him to his earlier species —*O. maculatus*—from the Simla Hills. In the case of the last species there seems no doubt that he had only young specimens. *O. griffithii* is similar to *O. sinuatus* Heckel, but the species of this genus are so ill defined that it seems advisable to retain the Kabul river form as a separate variety at least for the time being.

The specimen from the Paghman River is 4.6 inches long, and corresponds in all essential respects with a large number of specimens collected by my colleague Dr. B. N. Chopra in the Chitral Valley from the Chitral River (or Kunar River) and its tributary streams. Among the characters of *O. griffithii* McClelland mentioned, 'Dorsal spine large, vertical scales at the anal obsolete, posterior margin of the operculum round, snout smooth', and pointed out that the 'species although perfectly distinct, differs but little in appearance from *Oreinus plagiostomus*'. Unfortunately no specimen of *O. griffithii* was despatched by McClelland to the 'Museum at the India House', though a number of examples of the other species were sent.

b. A note on a species of Trout from the Hindu Kush.

In his notes concerning the fishes of Afghanistan Griffith[1] remarked that 'On crossing the great chain, separating Afghanistan from the plains of Toorkistan, which may be accomplished without exceeding an altitude of 13,000 feet, even by taking the highest route, that of the Erak Pass, a great change in the fish appears to occur, and Salmonidae appear to take precedence of the Cyprinidae'. He found that a species of trout 'abounds in the Bamean river, and up its small tributaries derived from the Koh-i-Baba to an altitude of 11,000 feet'. 'The curious change in the fish', he further observed, 'does not appear to be accompanied by any marked change in the physical configuration of the country, in its plants, animals, or birds'. This trout was described as *Salmo orientalis* by McClelland[2] and stated to 'differ from all known members of the family in the size of the head and the depth of the body. He remarked further that this was the 'first instance of Salmon having been found anywhere in the vicinity of India. There are no *Salmonidae* in Afghanistan, or any of the countries to the south of the Hindoo Koosh; the latter would therefore appear to be the boundary between the peculiar species of India, and those of Europe and northern Asia'. Next year, 1843, he[1] published a 'Memorandum regarding *Salmo orientalis*, or Bamean Trout', in which he tried to explain the absence of *Salmonidae* from Indian waters (a few species of Trout have since been introduced in the Nilgiris and the Kulu Valley) by assuming that 'However suitable the Himalayan and other mountain streams south of the boundary just noticed might be in point of temperature, and other circumstances adapted to the development of the young Salmon, yet the tropical seas into which these waters fall would be fatal to them, so that the absence of Salmon may be easily accounted for in all countries, the rivers of which have no communication with the seas of the temperate climates. The sea is essential to Salmon, indeed it is their natural abode, as they leave it only for the purpose of spawning. It is evident, therefore, that the Salmon must ascend the Oxus from the Sea of Aral, a distance of 1,200 miles, to the place where they were discovered by Mr. Griffith at an elevation of 11,000 feet, nearly equal to the mean elevation of the highest chain of the Alps, from Mount Blanc to Mount Rosa'. Though McClelland had given a new name[2] to this trout, he was very diffident about it and remarked that 'as specimens have been sent to England[3] with the collections of Mr. Griffith, the question may there be decided'. According to Griffith the Hindu Kush trout 'takes the worm greedily, generally gorging the hook. In sunny days, in winter, it takes the fly freely, although the cold is exceedingly severe'.[4] The species is also found at Bajgah a few marches from Bamean nearer the plains of Turkestan where according to Captain Hay it is said to attain a considerable size, and its flesh is very delicately flavoured.

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[1] Griffith, *Calcutta Journ. Nat. Hist.* II, p. 556 (1842).
[2] McClelland, *ibid.* p. 585 (1842).

Though McClelland had sent 3 specimens of the Bamean Trout to England, it seems that they were not available in the British Museum when Günther[5] wrote his *Catalogue of Fishes*, for he says regarding the Trout from the rivers of the Hindu Kush that 'This species appears to be the southernmost in Central Asia, and the nearest to the Indian region. There are no Salmonids in Afghanistan or any of the countries to the south of the Hindoo Kush. McClelland named this fish *Salmo orientalis*, which name cannot be retained, if the fish should prove to be a distinct species, as it was given to another fish by Pallas. The notes added by McClelland allude to characters of the genus only; and the figure (pl. 1) is too rude to assist in the determination of the species'.

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[1] McClelland, *Calcutta Journ. Nat. Hist.* III, pp. 283-287 (1843).

[2] McClelland's choice of the name *Salmo orientalis* was, apart from other considerations, unfortunate as a trout with the same name had already been described by Pallas in 1811.

[3] From the list of specimens sent to England by McClelland (*Cal. Journ. Nat. Hist.*, II, p. 573) it is seen that 3 specimens of *Salmo orientalis* were sent by him to the Museum at the Indian House.

[4] McClelland, *Calcutta Journ. Nat. Hist.* III, p. 287 (1843).

[5] Günther, *Cat. Fish. Brit. Mus.*, VI, p. 115 (1866).

Since McClelland's time *Salmo oxianus* has been described by Kessler[1] from Darant river which falls into Kizil-su, one of the upper tributaries of the Oxus. Berg[2] has described *Salmo aralensis* from the same river system. Boulenger[3], however, regarded the southernmost trout as *Salmo trutta* var. *fario* Linn. To an ichthyologist there is no other group of fishes which offers so many difficulties with regard to the distinction of species as the *Salmonidae*, and as there is no material of this group in the collection of the Indian Museum I am not in a position to express an opinion on the specific position of the Bamean Trout, but having recently obtained a specimen from the Hindu Kush I propose to describe it in detail for convenience of reference in future.

The Bamean Trout.

(Plate, figs. 3 and 4).

Mr. (now Sir) R. R. Maconachie sent to the Secretary of the Bombay Natural History Society in February, 1931, a specimen of a trout from N. Afghanistan with the following remarks: 'It appears to be a brown trout and is called a trout by the Afghans, but British officers in India with whom I have discussed the subject are very sceptical as to the occurrence of true trout in Afghanistan. The specimen sent was caught at Bamean 100 miles north of Kabul, and similar fish are said to be abundant in rivers north of the Hindu Kush'. The specimen is, unfortunately, not in a good state of preservation as it has become hard and crooked on account of desiccation. There is no doubt, however, that it represents a true trout and the same species to which reference was made by Griffith. In the collection of the Zoological Survey of India there are two other specimens collected in north Afghanistan. One[4] of these (No. 11406) was collected by Dr. G. M. Giles of the Gilgit Mission at an elevation of 8,000 ft. from the Kokcha river which lies in the north-east of Afghanistan. The other[5] specimen (No. F 1560/1) was obtained by Sir Henry Hayden at an altitude of 10,000 ft. from a small stream running into Ak (Agh) Robat Kotal (Pass) to join Bamean river, N. Afghanistan. The last two specimens are labelled *Salmo oxianus* Kessler and *S. fario oxianus* Kessler respectively. The specimen obtained by Sir Henry Hayden is in a good condition and, consequently, the following description and figures are made from this example, which is about 6.5 inches in total length (Parr-state).

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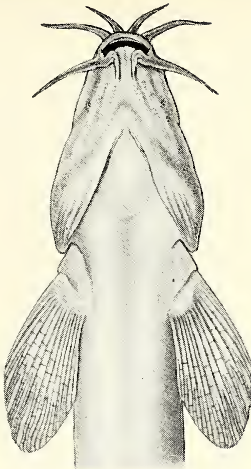
[1] Kessler, 'Pisces' in Fedtschenko's *Reise in Turkestsn*, p. 35 (1874).

[2] Berg, *Ann. Mus. Zool., St. Petersburg*, XIII, pp. 315-323 (1908).

[3] Boulenger, *Field*, cxi, p. 393 (1908). (Not seen, quoted from Berg, *op. cit.*, p. 48).

[4] On the 17th December, 1886, 4 specimens of *Salmo* (Nos. 11403-11406) were registered as having been obtained by Dr. G. M. Giles (Gilgit Mission) in the Kokcha river; but, unfortunately there is only one specimen now, the history of the other three is not given in the register.

[5] This is also one of the three specimens obtained by Sir Henry Hayden, the other two cannot be traced in the collection.



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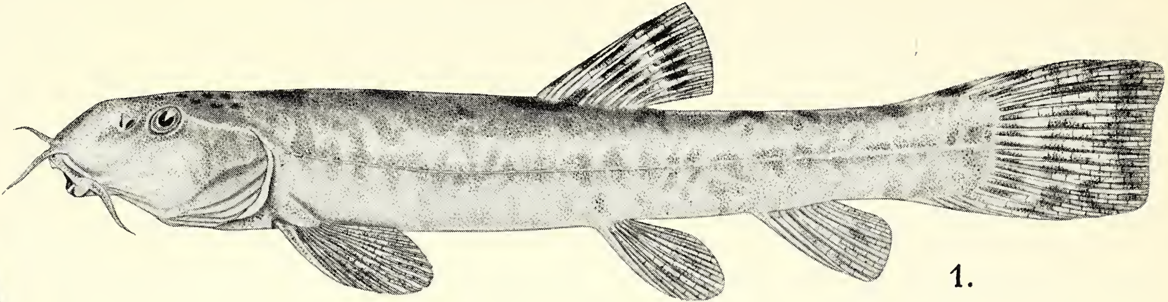

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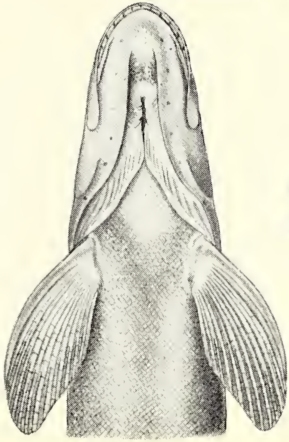

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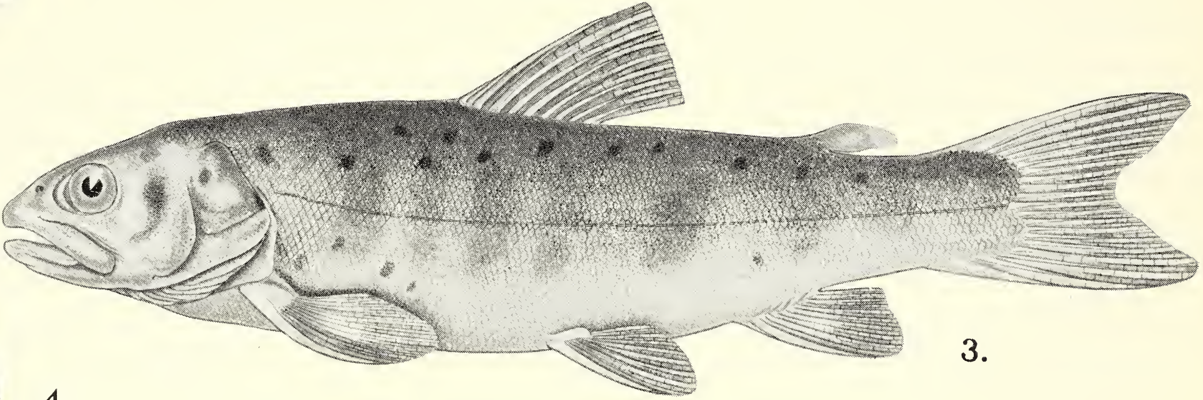

3.

R. Bagchi del

FISH OF AFGHANISTAN.

D. 3/8; A. 2/9; P. 13; V. 9; C. 19.

In the Bamean Trout the head and the body are gracefully stream-lined and are compressed from side to side. The length of the head is contained 3.5 times and the greatest depth of the body, which is just in front of the commencement of the dorsal, is contained 3.8 times in the total length without the caudal. The width of the head is contained 1.7 times and its height at occiput 1.6 times in its length. The diameter of the eye is contained 4.6 times in the length of the head, 1.2 times in the length of the snout and 1.3 times in the inter-orbital width. The opercular bones are thin and the hind border of the gill-cover is obtusely rounded; the suboperculum projects beyond the operculum and forms the hindermost projection of the gill-cover. The posterior point of junction of operculum and sub-operculum is slightly nearer to the lower anterior angle of the sub-operculum than to the upper end of the gill-opening. The pre-operculum has a very short lower limb; its hind border is rounded and convex. The operculum is short, its length being contained 1.3 times in its depth. The snout is rather short and obtusely pointed; the maxillary bones are much longer than the snout and extend to below the posterior margin of the orbit. The eyes are fairly large, almost lateral in position, slightly visible from the dorsal surface, but not visible from the ventral surface. The diameter of the eye is contained 4.6 times in the length of the head, 1.2 times in the length of the snout and 1.3 times in the interorbital distance. The nostrils are small and are placed much nearer the eyes than the tip of the snout. The mandible, maxillary, intermaxillary and palatine bones are provided with small, sharp and inwardly-directed teeth. There is a single row of 7 to 8 teeth in the middle line of the anterior portion of the vomer and there is a double row of teeth on the tongue.

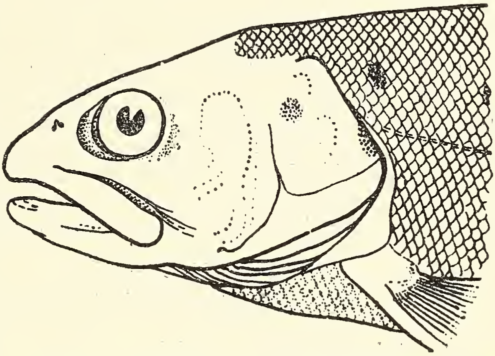

Fig. 1.—Lateral view of head and anterior part of body of the Bamean Trout (*Salmo trutta* var. *fario* Linn.).

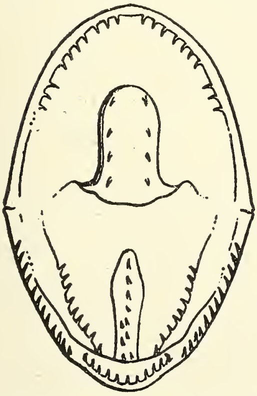

Fig. 2.—Arrangements of tooth-bands of the Bamean Trout (*Salmo trutta* var. *fario* Linn.). Diagrammatic.

The dorsal fin commences considerably in advance of the ventral, and its commencement is much nearer to the tip of the snout than to the base of the caudal. The adipose dorsal is short and is situated posterior to the base of the anal fin. The longest ray of the anal fin is twice the length of its base. The pectoral fin is pointed and is much shorter than the head; it is separated from the ventral fin by a distance equal to the post-orbital portion of the head. The ventral fin is much shorter than the pectoral and is provided with a fleshy appendage in its axil. The anal-opening is situated at the base of the first ray of the anal fin and is preceded by a narrow groove bordered by scaly flaps. The caudal fin is slightly emarginate. The caudal peduncle is very muscular; its least height is contained 1.7 times in its length.

The lateral line is complete and distinguishable; it runs from behind the gill-opening to the middle of the base of the caudal fin. The scales are small and silvery; there are about 27 rows of scales between the lateral line and the base of the dorsal fin.

There are about 8 broad, dusky cross bars on the body which are distinguishable when the specimen is kept in spirit. There are numerous, irregularly distributed black spots on the head, above the pectoral fin and more particularly on the sides of the body above the lateral line. The fins are without any special markings. Behind the eye there is usually a patch of black pigment, and also just near the hinder end of the gill-cover.

Measurements in millimetres.

Total length without caudal	125.0
Length of head	35.3
Width of head	20.0
Height of head at occiput	21.8
Length of snout	9.7
Interorbital width	10.0
Length of maxillary	17.5
Diameter of eye	7.7
Depth of body	33.0
Length of caudal peduncle	24.0
Least height of caudal peduncle	14.0
Length of pectoral	25.5
Length of ventral	19.3
Length of dorsal	22.5
Length of anal	21.0

Remarks.[1] Kessler[2] in decribing his *Salmo oxianus* referred to *S. orientalis* McClelland (*nec* Pallas), but regretted that it was not possible to define the specific limits of McClelland's species from his descriptions and figures. He indicated that his species was closely related to *S. fario*, several varieties and subspecies of which were known to occur in fresh waters throughout their lives. Berg[3] in describing *Salmo trutta aralensis* referred to the Turkestan Trout and indicated that it should be designated as *Salmo*

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[1] Mr. L. Bogdanov has helped me with the Russian text of Kessler's and Berg's descriptions of species, and for this I offer him my sincerest thanks.

[2] Kessler, 'Pisces' in Fedtschenkoi's *Reise in Turkestan*, p. 36 (1874).

[3] Berg, *Ann. Mus. Zool. Acad. Imp. Sci., St. Peters*, xiii, pp. 315-316 (1908).

fario oxianus Kessler (the specific name *orientalis* of McClelland being preoccupied). In his opinion the Turkestan variety could be distinguished from the typical form by its longer head and greater number of gill-rackers. The Aral Salmon was characterized by him as a subspecies of *Salmo trutta*, and distinguished from the typical form by its longer head, longer maxilla and mandible, and by the relatively shorter distance between the pectoral and the ventral fins. He also pointed out the differences between the Caspian Salmon and the Aral Salmon, both of which are considered as varieties of *Salmo trutta*. Further it is known that *S. fario* is subject to a great range of variations. It is for this reason, I believe, that Boulenger[1] assigned an extensive range of distribution to *S. trutta fario* and included in it the Turkestan Trout.

ADDENDUM.

An advance typed copy of the above article was sent to Professor L. S. Berg of the Institute of Ichthyology, Leningrad, for favour of criticism and suggestions. Prof. Berg has very kindly made a few observations in a letter which throw further light on our knowledge regarding the fish of Afghanistan. In consequence, I have thought it advisable to publish the following abstracts from this letter to facilitate reference in future as well as to complete the above account. I am very grateful to Prof. Berg for the great interest and trouble taken by him.

'From the zoogeographical point of view the fish-fauna of Afghanistan is of extraordinary importance, this land being situated at the limits of Mediterranean (Amu-daria and its drainage, Murghab, Hari-rud, drainage of Hamun Lake), High-asiatic (Pamir, probably Kafiristan also) and Indian (the lower Kabul) subregions.'

'In a paper by E. Keserling entitled "Neue Cypriniden aus Persien" (*Zeitschrift für die Gesammten Naturwissenschaften* xvii, pp. 1-24, pls. i-ix, 1861) are described some species from N.-W. Afghanistan, *viz.* from the Hamun basin and the Hari-rud River.

'P. 3. *Barbus microlepis*, pl. i, from a river at Anardareh between Herat and Lash, system of Hamun Lake. Nomen praeoccupied = *Schizothorax zarudnyi* (Nik.).

'P. 11. *Scaphiodon heratensis*, pl. v, from Hari-rud at Herat. = *Varicorhinus heratensis*.

'P. 14. *Scaphiodon asmussi*, pl. vi, from warm springs at Sultan Karaul, 8 miles N.-E. of Herat. = a form of *V. heratensis* with deeper body.

'P. 16. *Discognathus variabilis* Heck. from a rivulet at Anardareh. = *Discognathichthys rossicus* (Nikolsky) or *D. rossicus* infraspecies *nudiventris* (Berg) 1905.

'P. 19. *Bungia nigrescens*, pl. viii, from Hari-rud at Herat. Probably = *Gobio gobio lepidolaemus* with broken pharyngeal teeth (5-5 according to Keserling, instead of 5.2-2.5).

'P. 21. *Squalius latus*, pl. ix, from Hari-rud at Herat = *Leuciscus latus*.

'More details are to be seen in my Fishes of Turkestan, *Faune de la Russie* and *Poissons des eaux douces de la Russie*.

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[1] Boulenger, *Field*, cxi, p. 393 (1908).

'Besides the species mentioned by Keyserling there are known from the rivers Hari-rud (=Tejen or Tedshen) and Murghab the following species:—

'*Schizothorax pelzami* Kessler.
Alburnoides bipunctatus eichwaldi (Filippi).
Nemachilus malapterurus (Val.).
Cobitis aurata Filippi.'

'If you include *Salmo orientals*, or *S. oxianus*, in the fauna of Afghanistan, you have to enumerate also all the species occurring in the Upper Amudaria, *viz.*, *Pseudoscaphirhynchus kaufmanni* (Bogdanov), *Ps. hermani* (Kessler), *Salmo trutta aralensis* morpha *oxianus* (*fario*), *Rutilus rutilus aralensis* Berg, *Aspiolucius esocinus* (Kessler), *Varicorhinus heratensis steindachneri* (Kessler), *Barbus capito conocephalus* Kessler, *Barbus brachycephalus* Kessler, *Schizothorax intermedius* McClelland, *Alburnoides bipunctatas eichwaldi* (Filippi), *Capoetobrama kuschakewitschi* (Kessler), *Cyprinus carpio*, *Abramis sapa* (Pallas), *Pelecus cultratus* (Linné), *Nemachilus oxianus* Kessler, *N. amudarjensis* Rass, *N. stoliczkae* (Steind.), *N. malapterurus longicauda* (Kessler), *Silurus glanis* Linné and *Glyptosternum reticulatum* McClell.'

'I do not doubt that *S. orientalis* McClell and *S. oxianus* Kessler refer to the same fish. It is a fresh-water form (morpha *fario*) from the anadromous *Salmo trutta aralensis* Berg. I do not regard it as synonymous with *S. fario* Linné; the last form is a fresh water derivative from the northern *S. trutta trutta*. The synonyms under *Salmo fario* in my book 'Fresh-water fishes of Russia', 1916, pp. 47-48, refer to all the three subspecies of *S. trutta*, *viz.*, *S. trutta trutta*, *S. trutta labrax*, *S. trutta aralensis*. The morphae *fario*, of these subspecies although bearing the same name *fario*, are distinct. In my Fauna de Russie, Poissons, the same names are used everywhere for parallel morphae, for example, high forms of *Cyprinidae* are designated as morpha *elata*, elongate ones as morpha *elongata* (without any author's name).

'It would be of interest to ascertain the number of vertebrae in *Salmo oxianus*. The Mediterranean brook trout described as *S. macrostigma* Dum., has fewer vertebrae (average 57.0) than the northern *S. fario* (average 58.7 from the Baltic drainage).

'To the fauna of Afghanistan must be added also *Nemachilus boutanensis* McClell., *N. griffithii* Günther and *Silurus afghana* Günther.'

EXPLANATION OF PLATE.

Nemachilus griffithii.

Fig. 1.—Lateral view of Paghman specimen × 1½.
Fig. 2.—Ventral surface of head and anterior part of body of same × 1½.

The Bamean Trout.

Fig. 3.—Lateral view of the specimen obtained by Sir Henry Hayden in N. Afghanistan. Same size.
Fig. 4.—Ventral surface of head and anterior part or body of same. Same size.

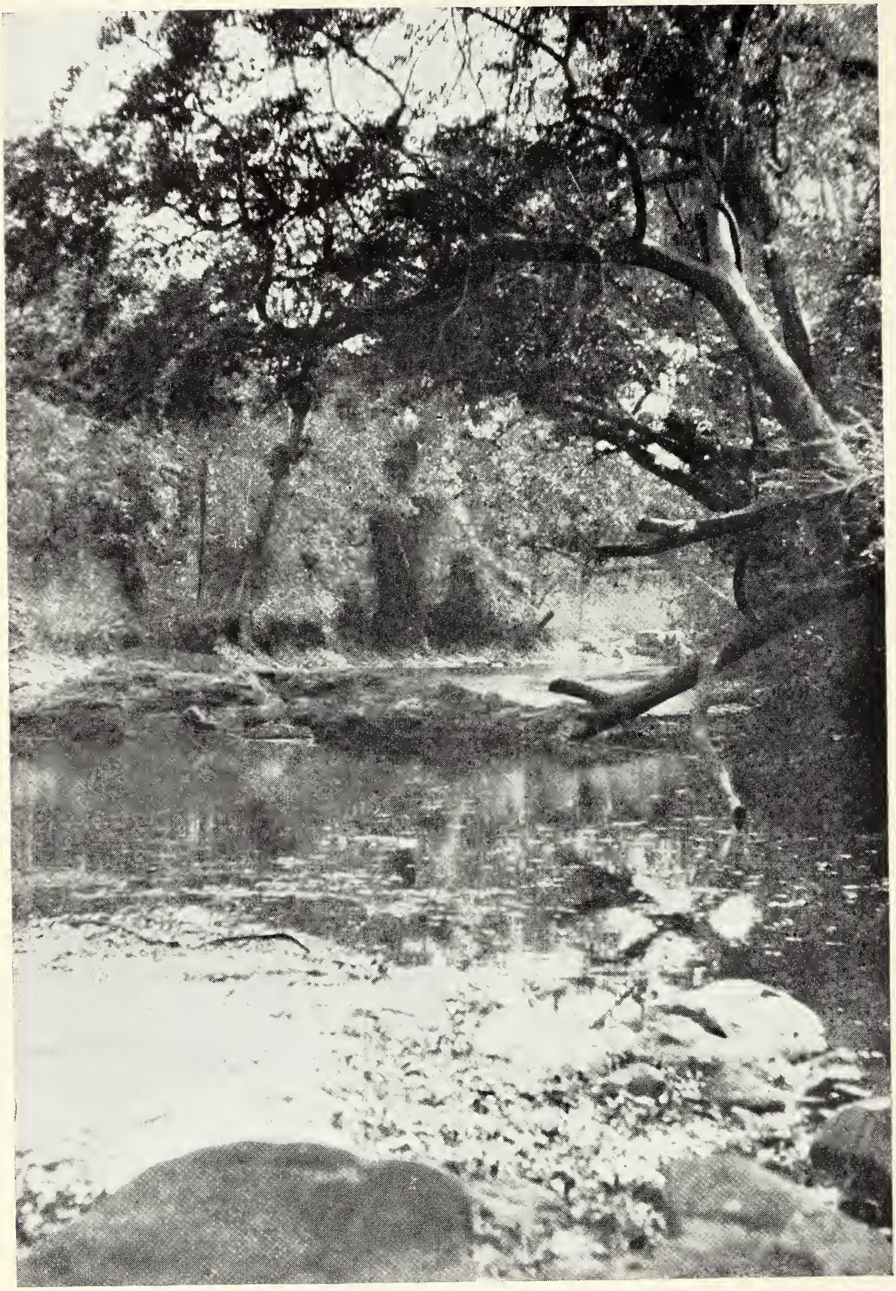


Photo by *Author.*

Arti-Margoo, a rock-pool in a forest stream near Utnoor, the hot weather refuge of the bird-life for miles around.

THE HYDERĀBĀD STATE ORNITHOLOGICAL SURVEY

BY

SĀLIM ALI

With Notes by Hugh Whistler.

PART II

(*With two plates*).

(*Continued from page* 390, *Vol.* xxxvi).

FAMILY: LANIIDÆ.

Lanius excubitor lahtora Sykes. The Indian Grey Shrike.

Collurio lahtora Sykes, P.Z.S., 1832, p. 86 (Deccan).

Specimens collected: 23 ♂ 5-10-31, 44 ♀ 7-10-31 Manānūr 2,000 ft.; 228 ♀ 3-11-31 Borgampād 160 ft.; 491 ♂ 1-3-32, 498 ♂ 2-3-32 Kandahār 1,400 ft.; 692 ♂ (juv.) 15-4-32 Aurangābād 2,000 ft.; 708 ♂ 18-4-32 Kannad 2,000 ft.

Elsewhere noted at: Hyderābād City Environs, Malkāpūr (Nālgonda Road), Mūkhēr, Kaulās, Bāsar (Nizāmābād District).

Iris dark brown; bill horny-black; mouth pale pink or pale greyish-pink; legs and feet blackish-brown.

[After careful examination I can only confirm that the resident Grey Shrike of India is referable to the one race.—H.W.]

The Grey Shrike is sparingly but generally distributed in the western portion of the State but is absent in the eastern. I cannot but consider the specimen obtained at Borgampād to be an aberrant straggler. Besides this solitary example I did not meet with the species at all anywhere east of Malkāpūr ('common') ca. 25 miles E.S.E. of Hyderābād City and due North of Manānūr. However, I find a note in my diary of 14 October 1925 recording it as 'common' near Talāmadri village '15 miles from Utnoor'. No Grey Shrikes were seen by the Survey anywhere within 50 miles of Utnoor between April 1-10 (1932) and I cannot account for the above note except on the assumption that the birds disperse far and wide during the winter months, in which case the Manānūr and Malkāpūr (3 January) birds could also perhaps be accounted for this way! Jerdon saw it all the year round at Jālna. (Jerdon, B. of I., vol. i, p. 401.)

This shrike haunts open scrub and cultivated country interspersed with hedges and Babool trees, such in fact as commonly obtains in the Nānder, Aurangābād and other districts of the Mahrattwāda. Even here it was nowhere abundant, however, but pairs were frequently met with at intervals. No. 708 was the only example seen at Kannad. The specimen is remarkable in having the lower mandible twisted sideways and growing upwards beyond the upper mandible as in the Crossbill (*Loxia*). At Bhāmarvādi the species was apparently absent.

Breeding: In No. 491 (1 March) the testes had enlarged to ca. 8×5 mm., the bird being one of a pair which were either breeding or about to. No. 498 (2 March) also showed identical genital development. At Kaulās (27 March) H. found a nest in a Babool tree at about 15 feet with 2 full-fledged young (apparently just out of it) in the immediate vicinity. These could fly with difficulty, and it appeared probable that the nest contained more chicks which had moved further away. At Bāsar Railway Station (Nizāmbād Dist.,—29 March—a nest was discovered in the fork of a Babool at ca. 10 feet, along the railway embankment containing five three-quarter fledged chicks crowded into it with difficulty. The nest was a deep globular cup of thorny Babool twigs on the outside, with soft grass, tow, twine &c as lining. One of the parents approached while the nest was being examined, uttering a harsh '*Che-che*' which was responded to by the young in similar tones. No. 692 (15 April) was one of four full-fledged young just out of nest (skull very soft !) which, in the absence of a gun, H. was lucky enough to bring down with a stone. The testes of No. 708 measured ca. 6×3 mm. and appeared to be developing.

From the above evidence it appears that during the months of March and April, breeding is at its height.

Davidson and Wenden found it breeding abundantly in the Poona and Sholapur collectorates at the end of the hot weather, also at Nulwār and Rāichūr. It was observed to be very rare in the Satāra district. (S.F., vol. vii, p. 79.

Lanius vittatus Valenc. The Bay-backed Shrike.

Lanius vittatus Valenc., Dict. Sci. Nat., xl (1836), p. 227—Pondicherry.

Specimens collected: 3 ♂, 5 ♂ 25-9-31, 10 ♂ (imm.) 27-9-31 Hyderābād City Environs 1,800 feet; 79 ♀ 10-10-31, 134 ♂ (imm.) 14-10-31 Manānūr 2,000 ft; 512 ♀ 5-3-32 Kandahār 1,400 ft.; 600 ♂ 23-3-32 Kaulās 1,350 ft.; 724 ♀ 20-4-32 Bhāmarvādi 2,500 ft.

Elsewhere noted at: Mahbūbnagar District (along Jedcherla-Achampēt Road), Borgampād, Nelipāka, Pāloncha, along road from Nekonda to Narsampēt, Āsifābād, Mālegāon (Mrs. Tasker !), Utnoor, Aurangābād, Kannad.

Iris dark brown; bill horny-brown or black—in immature birds paler at base of lower mandible; mouth pink in adult, yellow in juvenile; legs, feet and claws plumbeous or horny black, paler in young birds.

[This species has no races. H.W.]

Common throughout the State, frequenting open scrub jungle, cultivation and fallow or water-logged land with a sprinkling of Babool trees. Occasionally also found in deciduous forest. Usually met with singly or in pairs, but sometimes small parties of parents and young keep together.

Breeding: No. 10 (27 September) was one of five fully-fledged young in immature plumage in company of parents who kept a very vigilant lookout and warned the young of approaching danger by a harsh *chur-r-r* note. On 3 and 4 October (Manānūr) also, many such immature-plumaged birds were observed in company of their parents. No. 134 had the skull still soft on 14 October. No. 512 (5 March) was apparently moulting from juvenile into adult plumage. No. 600 (23 March) had the testes ca. 5×4 mm. and was obviously preparing to breed.

The breeding season given in the *Fauna*, viz. April to July, would seem to apply to this area also except that in some cases it may manifestly be prolonged to August or September, as suggested by specimens Nos. 10 and 134. By about the middle or end of March males were heard singing a pretty, rather subdued little rambling song from the interior of bushes, and from the general behaviour of the pairs about this time it was clear that they were about to breed.

Col. Sparrow found nests at Trimulgherry from 20 February to 14 June. He considers March and April, as the best months for them.

Lanius schach caniceps Blyth. The Grey-backed Shrike.

Lanius caniceps Blyth, J.A.S.B., xv (1846), p. 302—India—Madras (see J.B.N.H.S., xxxiv, p. 396).

Specimens collected: 39 ♂ (imm.) 6-10-31 Manānūr 2,000 ft.; 200 ? 30-10-31, 229 (imm.), 230 ♂ 3-11-31 Borgampād 160 ft; 355 ♂ (imm.) 21-11-31 Pāloncha 300 ft.; 611 ♀ 24-3-32 Kaulās 1,350 ft.

Elsewhere noted at: Hyderābād City Environs, Nelipāka, Nekonda, Narsampēt Āsifābād, Mālegāon (Mrs. Tasker !), Kandahār, Mūkhēr, Nandēr, Jālna, Bhāmarvādi.

Iris dark brown; bill dark horny-brown, paler at gape and base of lower mandible; mouth pale greyish-pink, yellower in younger birds; legs and feet slaty-brown or black.

[It is quite likely that the birds seen at Aurangābād and Bhāmarvādi were really *erythronotus* as in a great part of its range it is a summer visitor only, and those birds must winter somewhere down in the Peninsula. All the specimens are *caniceps* in my opinion. The two races are very close.—H.W.]

Generally distributed, common and abundant everywhere in the neighbourhood of cultivation and in open scrub country, often in association with

Lanius e. lahtora and *L. vittatus*. At Borgampād it was noted as 'the commonest shrike'; at Bhāmarvādi as 'not common'. Very partial to groves of young date and *Borassus* palms. Has a harsh complaining cry as if in distress, some of these notes also being exactly like those of a frog caught by a snake. At Narsampēt, one was observed hawking insects in the air, launching short sallies, turning and twisting on the wing and returning to its perch with the quarry. On 1 December I have first recorded that the birds had commenced 'singing' from exposed but shady perches during the heat of the day.

The birds at Aurangābād and Bhāmarvādi appeared to be less grey and more rufous on the back, and nearer *erythronotus*.

Breeding: No. 39 (6 October) was a young bird with a soft skull. 229 (3 November) and 355 (21 Nov.) were also young but slightly older than 39. The former had two soft patches on the skull while in the latter the unossified portion was confined as a single patch to the centre. These examples were apparently of broods fairly late in the monsoon.

On 13 April, near Jālna, H. observed from the running train a bird at its nest in a Babool tree by the line, apparently feeding young.

Col. Sparrow found nests near Trimulgherry between 20 April and 26 August. He considers June, July and August the best months for eggs.

Lanius cristatus cristatus Linnæus. The Brown Shrike.

Lanius cristatus Linn., Syst. Nat., ed. x (1758), p. 93—Bengal.

Specimens collected: 279 ♀ (imm.) 9-11-31 Nelipāka 160 ft.; 366 ♂ 21-11-31 Pāloncha 300 ft.; 650 ? 4-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Deglūr (14-3-32).

Iris brown; bill horny-brown, paler at gape and base of lower mandible; mouth pale pinkish-flesh; legs and feet bluish-grey; claws brown.

[I have seen other specimens from Hyderābād in Col. Sparrow's collection as follows: ♂ 6-11-12, ♂ 9-12-10 Trimulgherry; ♂ 10-12-10 Nadiārum and ♂ 18-2-11 Mirzapalli.

All the three Survey specimens are first year birds. The two obtained in November are in body moult and the spring bird (No. 650) is undergoing a complete moult. See *Fauna* Vol. ii, p. 283 and correction by C. B. Ticehurst, J.B.N.H.S. xxxi, p. 495.—H.W.]

In the cold weather this species appears to be sparingly distributed throughout the State, though perhaps it is somewhat more common in the eastern than in the western portions. I have always seen it singly. It is likely, however, that this bird is often confused with some of the immature-plumaged examples of *Lanius s. caniceps* although with field-glasses there should be no confusion between the two. The colour of the upper parts from bill to upper edge of rump is conclusive, being grey in *caniceps* and rich brown in *cristatus*.

No. 279 (9 Nov.) was a young bird with soft skull.

Tephrodornis pondicerianus pondicerianus (Gmelin). The Wood Shrike.

Muscicapa pondiceriana Gmelin, Syst. Nat., i (1789), p. 930—Pondicherry.

Specimens collected:—62 ♂ 8-10-31, 76 ♂ 10-10-31, 118 ♂ 13-10-31 Manānūr 2,000 ft.; 253 ♂, 254 ♂ 5-11-31 Borgampād 160 ft.; 431 ♀ 6-12-31 Pākhāl Lake 800 ft.; 499 ♂ 2-3-32 Kandahār 1,400 ft.; 603 ♂ 23-3-32 Kaulās 1,300 ft.; 736 ♀ (juv.) 737 ♀ (juv.), 22-4-32 Bhāmarvādi 2,500 ft.; 747 juv. 25-4-32 Kannad.

Elsewhere noted at: Hyderābād City and Environs, Singarenni Collieries, Nelipāka, Pāloncha, Āsifābād, Mūkhēr, Utnoor, Aurangābād, Kannad. "Common at Trimulgherry" (Col. Sparrow).

Iris greenish-brown; bill horny-brown, darker on culmen and at tips; mouth greyish-pink; legs and feet horny-brown, claws darker. In the three juveniles: Iris brown; bill horny-brown; gape cream colour; mouth pale lemon yellow; legs and feet bluish-slate; claws brown.

A generally distributed species throughout the Dominions, inhabiting boulder country, scrub and secondary jungle as well as deciduous forest, both hill and plain. Noted as particularly abundant at Utnoor and Bhāmarvādi—in deciduous forest—and in full song.

It is usually met with in parties of 3 or 4 birds flying from tree to tree and commonly as a member of the localised forest associations. The call is of several pleasant whistling notes, generally a "*wheet-wheet*" etc, ending in a quick interrogative "*whi-whi-whi-whee?*"

Breeding: The first signs of genital development were noted in specimen No. 499 (2 March) whose testes measured ca. 4×2 mm. and appeared to be enlarging. On 23 March (Kaulās) a nest was taken containing three hard-set eggs within a couple of days of hatching. No. 603, shot off this nest, had the testes ca. 6×3 mm., very pulpy in texture. Nos. 736 and 737 (juvenile, 22 April) were both taken from a single nest, strangely enough both females. On 23 April a third nest was taken containing 1 fresh egg. While the female was sitting on this, the male was seen to 'tread' her. No. 747 (25 April) was a juvenile, just able to fly.

The breeding season apparently is March and April and seems well-defined. Col. Sparrow considers April as the best month for eggs in the neighbourhood of Trimulgherry. The nests are neat cups composed of soft bark, fibres &c. cemented with cobwebs and draped on the exterior with bits of papery bark &c. which render them inconspicuous among the supporting branches. One measured 50 mm. (diameter of cup) × 30 mm. deep. All 3 nests were in open deciduous forest on leafless saplings, 16, 6 and 18 feet from the ground respectively.

The eggs are pale greenish-grey in ground colour, with brown specks thicker and forming a ring round the broad end. Three measured 18×15 mm. each. Both parents share in incubation and care of the young.

FAMILY: PERICROCOTIDÆ.

Pericrocotus roseusroseus (Vieillot). The Rosy Minivet.

Muscicapa rosea Vieillot, Nouv. Dict. d'Hist. Nat., vol. xxi, 1818, p. 486—Bengal.

On 23 April a pair was seen in the deciduous forest along the Outram Ghat Road at Bhāmarvādi (2,500 ft.). Unfortunately a specimen could not be secured as I hadn't a gun with me at the time, so this record must be accepted with reservation. The nearest definite record is Blanford's specimens (1 ♂ adult and 1 ♂ imm.—January 1871) from the Godavari Valley near Dumagudiam, which are now in the British Museum. D'Abreu obtained specimens at Nāgpūr as follows: ♂ 2-4-1912, ♀ 15-12-1911, ♀ 28-1-31.

Jerdon says however that he obtained it from various parts of Malabar (B. of I., vol. i, p. 423).

Pericrocotus peregrinus peregrinus (Linn.) The Small Minivet.

Parus peregrinus Linn., Syst. Nat., ed. xii, vol. i (1766), p. 342—No locality. Restricted to Ambala. (Bull. B.O.C. xl (1920), p. 115.)

Specimens collected:—52 [♀], 53 ? (imm), 54 ♂ 7-10-31, 115 ♂ 13-10-31 Manānūr 2,000 ft.; 243 ? (imm.), 244 ? (imm.), 4-11-31, 245 ♂ 5-11-31 Borgampād 160 ft.; 388 ? (imm.) 30-11-31 Narsampēt 800 ft.; 727 ♀ 20-4-32, 743 ♂ 24-4-32 Bhāmarvādi, 2,500 ft.

Elsewhere noted at: Hyderābād City and Environs, Nelipāka, Āsifābād, Kandahār, Utnoor, Aurangābād, Kannad.

Iris brown; bill horny-black; mouth pinkish-orange; legs, feet and claws horny-brown.

The claims of the two names *peregrinus* and *cinnamomeus* have been dealt with at length in the Eastern Ghats Report J.B.N.H.S., vol. xxxvi p. 343—and it is there shown why the former has been restored.

[I consider that *peregrinus* restricted to Ambala as type-locality originally by Stuart Baker must be used for the bird of the Peninsula from the upper Punjab down to the Cauvery River. To this form the Survey birds belong.—H.W.]

A generally distributed species, frequenting gardens, deciduous forest and the neighbourhood of cultivation wherever groves of Mango, Tamarind, *Nīm* and other large trees are present.

Breeding: Five of the specimens procured between 3 and 30 October were immature as evidenced by the imperfect ossification of their skulls. By the beginning of March it was observed that flocks had commenced to break up into pairs, and by the middle of that month pairs had become the general rule.

The first evidence of genital development was furnished by Sp. No. 743 (24 April)—in general body moult—whose testes measured ca. 4×2 mm., were firm in texture and appeared to be enlarging. When the breeding season actually commences I have no first-hand information, but it evidently continues till late in the monsoon, i.e. September or thereabouts. At Trimulgherry Col. Sparrow found nests between 22 June and 25 August. He considers the end of June and July the best time for eggs.

Davidson & Wenden (S.F., vol, vii, p.80) found it breeding in the rains in the Bhīma Valley, while at Poona Aitken has recorded a newly fledged young as late as 11 November (N.& E.,vol. i, pp. 339-343)

Pericrocotus erythropygius erythropygius (Jerdon). The White-bellied Minivet.

Muscicapa erythropygia Jerdon, Madras Jour. Lit. Sci., vol. xi (January 1840; after May 1840) p. 17—Jungle on the top of the Ghats near Ajanta.

Specimen collected:—110 ♂ 12-10-31 Manānūr 2,000 ft.

Elsewhere not noted.

Iris dark brown; bill dark horny-brown; mouth yellowish-brown; legs and feet dark horny-brown.

[I have also seen the following Hyderābād specimens: ♂ 30-5-09 Aurangābād. Shot in scrub jungle in dry bed of nullah (Col. H. R. Baker); ♂ 14-3-13 Eswantaraōpēt and ♀ 26-12-10 Medepal (Sparrow). Jerdon first procured it at Ajanta and afterwards saw it at Hyderābād (B. of I., i, 425)—H.W.]

The Survey specimen was one of a small flock of 4 or 5 in tall grass country interspersed with thorny bushes. It was not again met with in this locality or elsewhere within the State.

Breeding: Col. Sparrow took a clutch of 3 fresh eggs on 9-8-14 and found young in another nest on 16-8-14 in the jungle about 25 miles N.-W. of Trimulgherry.

Lalage sykesi (Strickland). The Black-headed Cuckoo-Shrike.

Lalage sykesi Strickland, Ann. Mag. Nat. Hist., (1) xiii (1844), p. 36—Calcutta.

Specimens collected: 20 ♀ 27-9-31 Hyderābād City Environs 1,800 ft.; 250 ♂ (imm) 5-11-31 Borgampād 160 ft.; 263 ♀ 8-11-31 Nelipāka 160 ft.; 566 ♀ 18-3-32 Kaulās 1,350 ft.

Elsewhere noted at: Manānūr, Kandahār. It was noted as 'absent' at Bhāmarvādi.

In adult: Iris dark brown; bill, legs, feet and claws horny-brown.

In first winter birds: Iris hazel brown; bill horny-brown, basal 2/3 of lower mandible yellowish; gape and mouth yellow; legs and feet dark slate; claws dark brown.

[No. 20 is adult. 250, 263 and 566 are all first winter birds. This bird has no races. It is to some extent migratory and Davidson and Wenden (S.F., vii, 80) call it a winter visitor to the Bhīma Valley. There is much other evidence that it is a migrant both further north and also further south of Hyderābād, but it is apparently found in Hyderābād all the year round as Sparrow says that at Trimulgherry it is common and breeds. He obtained eggs from 21 June to 8 August, mostly in July.—H.W.]

The Black-headed Cuckoo-Shrike keeps to secondary and open deciduous jungle and groves of Mango, *Nīm* etc., mostly in pairs. During the months in which I came across it in Hyderābād it was silent.

No. 250 was recovering from an injury on the shoulder apparently caused by the claws of some raptore.

Breeding: No. 250 (5 November) was an immature bird with soft skull. In none of the specimens were there any traces of genital development. Also see *supra*.

Graucalus javensis macei (Lesson). The Large Indian Cuckoo-Shrike.

Garucalus macei Lesson, Traité (end of 1830 or beginning of 1831), p.349—Bengal, now restricted to Calcutta.

Specimens collected: 163 ♂ 18-10-31 Farāhābād 2,800 ft.; 380 ♂ 26-11-31—Pāloncha 300 ft.

Elsewhere noted at: Manānūr, Borgampād, Nelipāka, Āsifābād, Kandahār, Utnoor, Kannad.

Iris reddish-brown or orange-brown; bill black; mouth greyish-pink; legs, feet and claws slaty-black.

No. 163 is adult; 380 a first-year bird.

Commonly distributed in the well-wooded portions of the State. Met with singly or in pairs or small parties following one another among the tops of tall forest trees and uttering a shrill '*Tee-eee*' (accent on 2nd syllable). I frequently observed it feeding on the figs of *Ficus religiosa* and *F. glomerata* in company with numerous other birds.

Col. Sparrow found it common in the cantonments at Trimulgherry in the cold weather but thinks that it returns to the jungles in the hot weather and rains, as he never succeeded in getting a nest.

Breeding: The organs of both the specimens were in an undeveloped condition, and no other evidence as regards breeding was obtained.

FAMILY: ARTAMIDÆ.

Artamus fuscus (Vieillot). The Ashy Swallow-Shrike.

Artamus fuscus Vieillot, Nouv. Dict. d'Hist. Nat., nouv. e., vol. xvii (1817) p. 297—Bengal.

Specimens collected: 179 ♂ 19-10-31 Farāhābād 2,800 ft.; 421 ♀ 3-12-31 Narsampēt 800 ft.

Elsewhere noted at: Borgampād, Āsifābād.

Iris dark brown; bill bright sky-blue, black at tips; mouth dark slate; legs and feet bluish-slate or slaty-brown; claws black.

[In its wide range of distribution this bird appears to have no races.—H.W.]

This bird appears to be rather patchily distributed in our area, being present in some localities and strangely enough absent from others to all appearances equally suitable. It was not common anywhere. On the whole, I noted it as more partial to *Borassus* palm country than to any other facies, but the precise biological connection between the two was not clear. At Farāhābād 8 or 10 birds were observed hawking insects high above a grassy clearing near the Bhīl hamlet of Mallāpūram in the midst of extensive forest. Their distinctive harsh '*Chek-chek-chek*' cries can be heard when the birds themselves are at a considerable height in the air. On a *Borassus* palm at Narsampēt 3 birds were noted in some sort of display, spreading their wings eagle-wise and screwing their outspread tails from side to side to the accompaniment of the usual harsh cries.

The stomach of No. 179 contained among other unidentifiable insect remains, two large dragonflies.

Breeding: Neither of the specimens showed any genital development, nor was any other evidence as regards breeding secured.

FAMILY: DICRURIDÆ.

Dicrurus macrocercus peninsularis Ticehurst. The Black Drongo.

Dicrurus macrocercus peninsularis Ticehurst, Bull. B.O.C., vol. liii, No. ccclxii (November 1932), p. 20—Madras City.

Specimens collected: 17 ♂ (imm) 27-9-31 Hyderābād City Environs 1,800 ft.; 51 ♂ 7-10-31, 63 ? 8-10-31 Manānūr 2,000 ft.; 189 ♂ 29-10-31, 226 ♀ (imm.) 2-11-31 Borgampād 160 ft.; 296 ♂ 13-11-31 Nelipāka 160 ft.; 430 ♂ 6-12-31 Pākhāl Lake 800 ft.; 481 ♂ 18-12-31 Āsifābād 1,200 ft.; 514 ♀ 7-3-32 Mūkhēr 1,350 ft.; 630 ♀ 2-4-32 Utnoor 1,250 ft.; 726 ♀ 20-4-32 Bhāmarvādi 2,500 ft.

Iris brownish-crimson; bill black; mouth pinkish-brown, slaty-black or slaty-pink. In young birds the iris is dark brown or reddish-brown; mouth pale pink.

[The *Fauna* is wrong in giving the type-locality of *macrocercus* as Orissa. It is really Java and this of course upsets all the arrangement in the *Fauna*. The Survey specimens belong to a race intermediate in size between *minor* of Ceylon and the large Himalayan bird. The Eastern Ghats Survey birds also belong to the same form.—H.W.]

The Black Drongo is one of the commonest and most widely distributed species in the State, chiefly frequenting cultivated areas and a constant attendant on grazing cattle. It is also found in deciduous forest often as a member of the localised forest associations. At Manānūr it was commonly observed in forest in company with *D. cærulescens*, and its defiant shikra-like calls were amongst the commonest bird voices at dusk.

At Borgampād (cultivated country) it was noted as most abundant, while it was distinctly scarce at Utnoor and Āsifābād, specially at the latter.

The Drongo is invariably present on the blossoms of *Bombax malabaricum Erythrina indica* and *E. suberosa, Butea frondosa* and *B. superba* and it undoubtedly plays an important part in the cross-pollination of these species. Specimens shot off the flowers showed large quantities of pollen adhering to the feathers of the chin and throat.

Breeding: From the state of ossification of the skull it was clear that No. 17 (27 September) and 226 (2 November) were immature—probably bred late in the monsoon. By 6 March the birds had commenced the 'scolding duets' which are such significant forerunners of the breeding season.

No. 514 (7 March) was excessively fat though its ovaries were in an undeveloped condition. In 630 (2 April) the ovarian follicles were clearly visible and appeared to be developing; in 726 (20 April) they measured ca. 1 mm. in diameter. From the fact, moreover, that by the last date the birds were mostly in pairs and somewhat excited, it was apparent that they were preparing to breed. The breeding season presumably commences in May and continues till about the end of the rains.

Dicrurus longicaudatus longicaudatus Jerdon. The Ash-grey Drongo.

Dicrurus longicaudatus Jerdon, Madras Jour. Lit. Sci., xiii, pt. ii (1845), p. 121—Segour Pass, Nilgiris.

Specimens collected: 143 ♀ 16-10-31, 175 ♀ 19-10-31 Farāhābād 2,800 ft.; 651 ♂, 652 ♂ 5-4-32, 666 ♂ 7-4-32 Utnoor 1,250 ft.

Iris brownish-red, reddish-brown or orange-red; bill, legs, feet and claws black; mouth brownish-pink, pale pink or slaty-pink.

This species was only met with in deciduous forest, never in open cultivated country like the foregoing. It was usually seen singly or in pairs, and frequently among the localised forest associations.

Breeding: The birds observed at Utnoor between 1 and 10 April were very noisy and appeared to be preparing to breed shortly. No. 652 (5 April) had testes measuring ca. 3×2 mm., while in No. 666 (7 April) they were somewhat larger. In both these specimens they appeared to be enlarging.

Dicrurus cærulescens cærulescens (Linn.). The White-bellied Drongo.

Lanius cærulescens Linn., Syst. Nat., ed. xii (1766), p. 134—Bengal.

Specimens collected: 49 ♂ 7-10-31, 116 ♀ 13-10-31 Manānūr 2,000 ft.; 145? 16-10-31, 149 ♂ 17-10-31, 173 ♀ 19-10-31 Farāhābād 2,800 ft.; 246 ♀ 5-11-31 Borgampād 160 ft.; 379 ♂ 26-11-31 Pāloncha 300 ft.; 653 ♀ 5-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Nelipāka, Narsampēt, Pākhāl Lake, Āsifābād, Kaulas, Bhāmarvādi, Vijāpūr (Aurangābād Dist., 18-31 October 1924). Also at Trimulgherry and Eswantarāopet by Col. Sparrow.

Iris brownish-red; bill black; mouth pale pink, slaty-pink or pale pinkish-yellow; legs, feet and claws black.

Commonly distributed throughout the State in well-wooded tracts, both hill and plain. It is a forest bird and I never met it in open cultivation far from groves or jungle. It is a frequent member of the localised forest associations and has a pretty call of 3 or 4 whistling notes which is amongst the commonest bird voices of the forest. It is also an excellent mimic; I have heard it taking off the Iora and Tailor-bird to perfection. In the case of the former not only were the various whistling notes reproduced, but also the occasional *chr-r-rs* with which these are punctuated.

I frequently observed this Drongo hawking insects in the air in the manner of a fly-catcher, turning and twisting on the wing with great agility, and keeping up the hunt till well after sunset when almost dark.

Breeding: By the beginning of April the birds had become particularly noisy—a significant phase with the Drongos—and were frequently observed chasing one another. Specimen No. 653 (5 April) had some of the ovarian follicles enlarged to over 2 mm. in diameter and it was obviously preparing to breed.

Dissemurus paradiseus grandis (Gould). The Racket-tailed Drongo.

Edolius grandis Gould, P.Z.S., 1836 (9 April 1836), p. 5—Nepal.

Specimens collected: 370 ♂ 25-11-31 Pāloncha 300 ft.; 423 ♂ 5-12-31, 428 ♂ 6-12-31 Pākhāl Lake, 800 ft.

Elsewhere noted at: Borgampād (Henricks !), Nelipāka, Narsampēt.

Iris brown or reddish-brown; bill, legs, feet and claws black; mouth pale greyish-pink, sometimes mottled with brown, yellow and slate.

[All the 3 specimens belong to the big northern race with the fine crest, thereby giving a slight extension of range. They are all adult.—H. W.]

Strangely enough I failed to come across this species on the Amrābād Plateau or at Āsifābād, Utnoor or Bhāmarvādi, all wooded-country and apparently well suited to its requirements. Even where occurring it was nowhere common, only being met with occasionally in pairs and that invariably as a member of localised forest associations together with *Turdoides somervillei* and *Dendrocitta vagabunda.* The birds were exceedingly shy everywhere. They have a large repertoire of loud musical rather metallic notes, some being a rich whistling *what-what-what-what* &c.

At Borgampād, Henricks noted an example on two successive days perched on the same stake in cultivation close to the village and at about the same time in the morning, on both occasions calling loudly. This is rather curious considering it was open cultivated country here with the nearest likely jungle at least two miles away! This was the only example seen in the neighbourhood.

Breeding: No. 370 (25 Novem.) was exceedingly fat. None of the specimens showed any gonadal development.

FAMILY: SYLVIIDÆ.

Acrocephalus stentoreus brunnescens (Jerdon). The Indian Great Reed-warbler.

Agrobates brunnescens Jerdon, Madras Jour. Lit. Sci., vol.. x, 1839 (after October) p. 269—Trichinopoly.

Specimens collected: 280 ♂ 9.11.31, 333 ♂, 334 ♂, 335 ♂ 17.11.31 Nelipāka 160 ft; 387 ♂ 30.11.31 Narsampēt 800 ft.; 496 ♂ 2.3.32 Kandahār 1,400 ft; 520 ? 7.3.32, 524 ♂ 8.3.32 Mūkhēr 1,350 ft.

Elsewhere noted at:—Pāloncha, Pākhāl Lake, Deglūr, Kaulas. Also Trimulgherry & Chinapur on 10.11.12 and Chintakani on 4.2.13 (Sparrow). Jerdon records it from Jālna.

First seen 8 November (Nelipāka); Last 18 March (Kaulās).

Iris pale hazel-brown or olive-brown; bill pale flesh colour, culmen and tip of lower mandible dark brown; gape and mouth bright orange or orange-brick; legs and feet pale greyish-brown; claws horny-brown; soles lemon yellow.

[I have recently had occasion (J.B.N.H.S. xxxv, pp. 450-452) to go into the question of the Indian races of this species and to discuss its breeding records in India. The possibility of its breeding in the vicinity of Bombay was discussed (loc. cit.) and Davidson (S.F., x, p. 307) thought that it possibly bred on the Tapti River below Prakasha. I do not, however, expect that it breeds up on the Hyderābād Plateau, though a female collected by Col. H. R. Baker at Aurangābād on 4-4-09 (now in my collection) extends the dates afforded by the Survey.—H.W.]

The Indian Great Reed-warbler was abundant in the beds of 'Tamarisk' (*Phyllanthus Lawii* Grah.) growing on mud-banks and spits on the edge of the Gadāvari River at Nelipāka. Elsewhere, single birds or 2 or 3 examples were noted haunting the bushes bordering or overhanging village tanks and water-logged fields. They are great skulkers and can be made to leave the thickets only with difficulty and after much beating. Everywhere the males were warbling vociferously, and this invariably was the first indication of their presence in any locality. A single note uttered as the bird hops among the bushes is a loud and harsh *Ke* repeated every few seconds and very reminiscent of *Turdoides somervillei.*

Only on one occasion did I meet a bird at any distance from water. This was in a dense clump of Bamboos along a cart track—probably for shelter from the mid-day heat—and it was warbling from time to time.

Photo by *Author.*

Tūmmalacherūvū tank near Nelipāka, a favourite bird haunt.

It is significant that all the specimens, save one which could not be determined, are males although some of them were actually silent when shot. No. 496 (2 March) was very fat, but none of the specimens showed any genital development.

Acrocephalus dumetorum Blyth. Blyth's Reed-warbler.

Acrocephalus dumetorum Blyth, J.A.S.B., vol. xviii, 1849 (after August), p. 815—India, Calcutta.

Specimens collected: 349 ♀ 20-11-31 Pāloncha 300 ft.; 389 ♂ (imm) 30-11-31 Narsampēt 800 ft.

Iris hazel brown; bill pale flesh-colour, culmen and tip brown; mouth in No. 389 (male) orange-brick, in No. 349 (female) pale lemon yellow; legs and feet greyish-brown; claws dusky.

[It is very difficult to distinguish this bird from *Hippolais rama* in the field, but its heavier beak, somewhat darker colour and graduated tail should often be appreciable. In the hand, the minute first primary, equal to or shorter than the primary coverts, at once distinguishes it from both *rama* and *scita*.—H.W.]

A common and generally distributed winter visitor, frequenting bushes and undergrowth where it hops about among the stems in search of insects, uttering *chuck-chuck* or *chur-r, chur-r* &c. Usually single. This species is very confusing with *Hippolais* and I omit field notes based on sight records as in most cases it is impossible to say with certainty that they refer to this bird and not to the other. Both are skulkers and resemble each other closely in their habits. This Reed-warbler (or may be both?) were very plentiful in the 'Tamarisk' beds of the Godāvari River at Nelipāka.

No. 389 was an immature bird with an unossified patch in the centre of its skull. No genital development was noticeable in No. 349.

Acrocephalus agricola Jerdon. The Paddy-field Warbler.

Sylvia (*Acrocephalus*) *agricola* Jerdon, Madras Jour. Lit. Sci., vol. xiii, pt. 2 (1845), p. 131—Nellore.

Specimens collected: 390 ♀, 391 ♀ 30-11-31, 408 ♀ 2-12-31, 445 ♀ 8-12-31 Narsampēt 800 ft.

Iris olive-brown, in No. 445 pale straw colour; bill pale flesh-colour, dark brown along culmen; mouth pale greyish-yellow, in 445 pale orange-yellow; legs feet and claws pale greyish-brown.

All the specimens were obtained amongst tall reeds standing in water on the edge of tanks. It was noted as common in the neighbourhood of Narsampēt and partial to standing water-logged paddy crops.

None of the specimens showed any gonadal development.

[The possibility that this Reed-warbler may breed in Hyderābād State should not be lost sight of, a point which I have already discussed in the *Ibis* (1928, p. 450).—H. W.]

Orthotomus sutorius sutorius (Pennant). The Tailor Bird.

Motacilla sutoria Pennant, Ind. Zool. (1769), p. 7—Ceylon.

Specimens collected: 311 ♂, 312 ? 14-11-31 Nelipāka 160 ft.; 670 ♂ 8-4-32 Utnoor 1,250 ft.; 733 ? 22-4-32 Bhāmarvādi 2,500 ft.

Elsewhere noted at: Hyderābād City and Enviorns, Hanamkonda (Warangal Dist.), Manānūr ('exceedingly common in forest'), Farāhābād ('less common than at Manānūr'), Singarenni Collieries, Borgampād ('fairly common'), Pāloncha, Narsampēt ('common'), Kandahār ('common'), Nīrmal.

Iris orange; bill pale flesh colour, brownish on culmen and near tip of lower mandible; mouth pale flesh colour; legs and feet brownish flesh colour; claws dusky.

[Additional specimens examined from Trimulgherry (Sparrow) and Aurangābād (H. R. Baker).

A good series of Tailor-birds from Ceylon is necessary to settle the question whether Indian and Cinghalese birds are subspecifically the same. The few specimens I have seen from Ceylon appear to be smaller and more saturated green above, with shorter central tail-feathers and no difference between summer and winter plumage. Should they prove separable, the prior name available for our Indian bird is apparently *Sylvia guzurata* Latham, Index. Orn. (1790), p. 554—Guzurat.—H. W.]

Generally distributed throughout the State frequenting gardens, scrub country especially in the vicinity of cultivation, as well as deciduous jungle where it usually keeps to the undergrowth. At Pāloncha it was often met with among the localised forest associations. In the Nāndēr District where mango groves abound, it was invariably seen hunting the insects attending on the blossoms. It was also noted as a regular frequenter of *Butea frondosa* flowers for nectar and very probably assists in their cross-pollination.

Breeding: Specimen No. 311 (14 September) had the testes ca. 3×2 mm., very pulpy in texture, and the bird was in heavy post-nuptial moult. The gonads of the rest gave no evidence as regards breeding. According to Mr. R. K. Burnett, a former principal of Nizām College, the Tailor Bird is a common host of the Plaintive Cuckoo (*Cacomantis merulinus*) in the environs of Hyderābād City.

Cisticola juncidis cursitans Franklin. The Streaked Fantail Warbler.

Prinia cursitans Franklin, P.Z.S. 1830-31 (October 1831), p. 118—Ganges between Calcutta and Benares.

Specimens collected: 123 [♂] 13-10-31 Manānūr 2,000 ft.; 369 ♂ (imm) 25-11-31 Pāloncha 300 ft.; 443 ♂, 444 ♂ 8-12-31 Narsampēt 800 ft.; 559 ♂, 560 [♂] 16-3-32 Deglūr 1,300 ft.; 621 ♂ 1-4-32, 683 ♂ 9-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Trimulgherry (Col. Sparrow!). Not observed at Aurangābād, Kannad or Bhāmarvādi.

Soft parts in ♂♂: Iris hazel brown, olive-brown, khaki or straw-colour; bill upper mandible horny-brown, lower mandible flesh-colour; mouth black in first summer and adult summer, fleshy-pink in first winter and adult winter.

Nos. 443 and 444 were in extremely worn summer dress as late as 8 December.

The Streaked Fantail Warbler was rare at Manānūr, but fairly common elsewhere in suitable country which consists of areas covered with tall grass or standing paddy crops etc. It has a rambling, undulating flight—in which the fan-shaped tail is conspicuous—sometimes skimming over the crops, at others rising high in the air in aimless zig-zags and after a few yards suddenly diving into the stems. It utters a feeble *chip, chip, chip* as it flies.

Breeding: In No. 369 (25 November) the skull showed the last traces of immaturity, while from the testes (ca. 4×2 mm., rather pulpy) and plumage of 443 and 444 it was apparent that they had recently finished breeding. The rest of the specimens had the organs in a quiescent state.

Col. Sparrow has taken eggs between 18 August and 18 September at Trimulgherry.

Franklinia gracilis Franklin. Franklin's Wren-Warbler.

Prinia gracilis Franklin, P.Z.S. 1830-1831 (October 1831), p. 119—Ganges between Calcutta and Benares.

Specimens collected: 71 ♂, 72 ♂ 9-10-31 Manānūr 2,000 ft.; 293 ♂ (juv) 12-11-31 Nelipāka 160 ft.; 371 ♂ 25-11-31 Pāloncha Hill 1,100 ft.; 451 ? 11-12-31 Āsifābād 1,200 ft.; 527 ♂ 8-3-32 Mūkhēr 1,350 ft.; 565 ♂, 569 ♂ 18-3-32, 594 ♂ 22-3-32 Kaulās 1,350 ft.; 639 ♂ 3-4-32 Utnoor 1,250 ft.; 745 ♀ 24-4-32 Bhāmarvādi 2,500 ft.

Elsewhere noted at: Hyderābād City Environs, Borgampād, Kandahār, Kannad.

Iris yellow to orange-brown: eye-rim brownish-yellow; bill black—in a first winter bird horny-brown—the commissure and tip paler; mouth black or dark brown; legs and feet pale yellow, brownish-fleshy or yellowish-fleshy; claws dusky.

In No. 293 ♂ juv.: Iris brownish-buff; bill brownish on culmen and gonys pale yellow on commissure, tips and sides of lower mandible; mouth pale flesh colour with brown blotches; legs and feet brownish-yellow; claws dusky.

[This species is evidently generally distributed as Blanford obtained specimens at Rājāmūndri, Dūmāgūdiem and S.E. Berar west of Chānda, all along the boundary of Hyderābād.

The series of Franklin's Wren-Warbler available in the British Museum and elsewhere is not very satisfactory, but on what I have examined I have so far failed to define any races in spite of the wide distribution.—H.W.]

Generally distributed in the State, affecting secondary and scrub jungle—both hill and plain—as well as tall grass-and-scrub country in deciduous forest. It is usually met with in flocks of 5-10 birds, the members of which keep in touch with one another by loud, pleasant tinkling notes. In October, males were observed warbling vociferously from exposed tips of trees in scrub jungle, or while clambering about the undergrowth. The song consists of a musical *chiwee, chiwee, chiwee, chip, chip, chip, chip*, commencing low and feebly, the *chips* rising in crescendo and ending abruptly. This species is also a frequent attendant on the blossoms of *Butea frondosa* for the nectar.

Breeding: The testes of Nos. 71 and 72 (9 October) were enlarged to 5×3 mm. and the birds were apparently breeding. The plumage and condition of the skull of No. 293 (12 November) showed that it was juvenile. In the rest of the specimens the gonads were undeveloped.

Col. Sparrow, who found it breeding commonly in the neighbourhood of Trimulgherry, obtained eggs between 11 July and 25 August.

Franklinia buchanani Blyth. The Rufous-fronted Wren-Warbler.

Prinia buchanani Blyth, J.A.S.B., vol. xiii, 1844, p. 376.—Bengal.

Not met with by the Survey, but there is a specimen in Col. Sparrow's collection labelled: ♂ 23-9-1912 Trimulgherry.

Hippolais rama rama (Sykes). Sykes' Tree Warbler.

Sylvia rama Sykes, P.Z.S., 1832 (July 31), p. 89—Dukhun.

Specimens collected: 231 ♀, 232 ? 3-11-31 Borgampād 160 ft.; 264 ♂ 8-11-31, 309 ♀ (imm) 14-11-31, 326 ? (imm) 16-11-31 Nelipāka 160 ft.; 463 ♀ 13-12-31 Āsifābād 1,200 ft.; 510 ♂ 5-3-32 Kandahār 1,400 ft.

The Sparrow collection contains the following specimens: ♂ 17-1-12, ♀ 17-3-12 Trimulgherry.

Iris hazel brown, or olive brown; bill pale flesh colour, culmen brown; mouth pale lemon yellow or bright yellow; gape yellowish-buff; legs and feet greyish-brown; claws dusky; soles pale lemon yellow.

[I have already given in the Eastern Ghats Survey Report (J.B.N.H.S., vol. xxxvi, p. 568) my reasons for considering *rama* and *scita* as races of one species.—H.W.]

A very common winter visitor throughout the Dominions, frequenting gardens, scrub jungle and Babool bushes separating fields, and in fact any country where bushes abound, save actual forest. It is met with singly clambering amongst the undergrowth or hopping from stem to stem in search of insects. It is an elusive bird seldom showing itself, but the subdued *chur-r, chur-r*—which is the only note I have heard it utter—issues from almost every bush. By the beginning of April the birds had become markedly scarce and 12th April was the last date on which one was seen.

Hippolais rama scita Eversmann. The Booted Tree-Warbler.

Sylvia scita Eversmann, Add. Pallas Zoogr. Rosso-Asiat., fasc. iii (1842) p. 12—Ural Mountains.

Specimens collected: 325 ♀ (imm) 16-11-31 Nelipāka 160 ft.; 460 ? 13-12-31 Āsifābād 1,200 ft.; 550 ♂ 14-3-32, 563 ♂ 16-3-32 Deglūr 1,300 ft.; 605 ? 24-3-32 Kaulās 1,350 ft.; 685 ? 9-4-32 Utnoor 1,250 ft.

Soft parts as in *H. r. rama*, but the upper mandible is horny brown, lower mandible yellowish-flesh colour, dusky towards tip.

[The last 2 specimens of the Survey series are very poor and identification is therefore not quite certain but they appear to be this. I have seen the following additional specimens from Hyderābād: ♂ 28-10-06 Aurangābād (Col. Baker); ♂ 3-3-12, ♂ 27-3-11 Trimulgherry (Col. Sparrow).—H.W.]

The differentiation of this bird from *H. r. rama* and from *Acrocephalus dumetorum* is difficult in the field. In their habits they are likewise very similar and in winter all three of them are very common and generally distributed in the State.

In No. 325 (16 November) the skull was imperfectly ossified, showing that the bird was on its first migration to its winter quarters.

Sylvia hortensis jerdoni Blyth. The Eastern Orphean Warbler.

Curruca jerdoni Blyth, J.A.S.B., vol. xvi (1847 May) p. 439—Southern India (Jaulnah).

(For restoration of the name *jerdoni* see *New Fauna* vol. viii, p. 640, based on Ticehurst and Whistler, Ibis 1929, p. 673.)

Specimens collected: 490 ♀ 1-3-32, 506 ♀, 507 ♂ 4-3-32 Kandahār 1,400 ft.; 554 ♀ 15-3-32 Deglūr 1,300 ft.

The following specimens in Col. Sparrow's collection extend the above dates: 1-11-13, 17-1-?, 18-1-13 Trimulgherry.

Elsewhere noted at: Mūkhēr.

Iris yellowish-white to lemon yellow; upper mandible and tip of lower mandible brownish-black, remainder of lower mandible pale grey; mouth in first winter bird (No. 490) pink, in adults greyish-pink; legs and feet greyish-brown; claws brown.

[This bird must be a common and generally distributed winter visitor in the Deccan as I have the following further records:

Deccan: 'Common' (Fairbank, S.F., iv, 260).

Deccan: 'Commonest in Sholapur during the cold season. We procured it in February, April and May' (Davidson and Wenden, S.F., vii, 84).

Jaulnah: Type locality. Procured there by Jerdon (B. of I. ii, 208).

Ahmednagar: A series of 8 specimens in the British Museum (Bruce and Fairbank) one December, one January, three March, three April (latest 27th). —H.W.]

The Orphean Warbler was met with singly by the Survey and in the Nāndēr District only. It frequented stony country with a sparse growth of stunted thorn bushes, also Babul trees and scrub separating fields of cotton and jowari. It utters *chuck-chuck* while skulking through the bushes, something like the note of the Whitethroat (*Sylvia curruca*) or of *Acrocephalus dumetorum*, but rather louder and deeper in tone. I sometimes observed it descending to the ground to pick up an insect.

Specimens Nos. 506 and 507 (4 March) were excessively fat and apparently preparing to emigrate.

Sylvia althœa Hume. Hume's Lesser Whitethroat.

Sylvia althœa Hume, S.F., vol. vii (1878) p. 60—Jhansi.

Specimens collected: 1 ♀, 7 ♂ 25--9-31 Hyderābād City Environs, 1,800 ft.; 258 ♀ 6-11-31 Borgampād 160 ft.

Elsewhere noted at Āsifābād, Kandahār and Mūkhēr.

Iris brown or hazel brown; bill horny brown, lower mandible paler; mouth fleshy pink; legs, feet and claws horny-black or bluish slate, claws brown.

Similar in habits to *Acrocephalus dumetorum* and *Hippolais rama* and like them common in winter. It affects the same type of open bush-and-Babul country and the *chuck-chuck* it constantly utters is also practically indistinguishable from their notes.

Sylvia curruca affinis Blyth. The Indian Lesser Whitethroat.

Curruca affinis Blyth, J.A.S.B., vol. xiv (after Aug. 29) 1845, p. 564—S. India.

Specimens collected: 458 ♀ 13-12-31, 466 ♀ 14-12-31, 480 ♂ 18-12-31 Āsifābād 1,200 ft.; 492 ♀ 1-3-32 Kandahār 1,400 ft.

Col. Sparrow's collection contains the following specimens from Hyderābād: ♂ 15-11-12, ♂ 17-1-12, ♂ 26-1-12 Trimulgherry ♂ 25-1-11 Jalna.

Iris brown; bill horny brown, lower mandible paler; mouth pinkish flesh, in No. 406 orange-pink; legs and feet bluish-slate; claws brown, slaty-black or dark horny-brown.

A winter visitor, almost indistinguishable in the field from *S. althœa* and doubtless often confused with it. Its habits and habitat are identical with the above.

Phylloscopus affinis (Tickell). Tickell's Willow-Warbler.

Motacilla affinis Tickell, J.A.S.B., vol. ii (November 1833) p. 576—Borabhum.

Specimen collected; 377 ♂ 26-11-31 Pāloncha 300 ft, Iris brown; bill horny-brown, gape and lower mandible orange yellow; legs and feet yellowish-brown, back of tarsus and soles lemon yellow.

[This record is a slight extension of the known range. On the west it is recorded from Khandāla and Mahābleshwar and it is a common winter visitor to the Nilgiris extending also to Travancore. On the eastern side it is not known to occur below the Chota Nāgpur area to Rāipur and Anantāgiri. In between these two areas, west and east, there is no previous record.—H.W.]

A winter visitor, frequenting scrub and secondary jungle, clinging upside down to sprigs of leaves, and making short sallies in the air after winged insects like a flycatcher.

Phylloscopus griseolus Blyth. The Olivaceous Tree-Warbler.

Phylloscopus griseolus Blyth, J.A.S.B., vol. xvi (1847), p. 443—Banks of the Hoogly.

Specimens collected: 283 ♂ 10-11-31 Nelipāka ca. 400 ft.; 471 ♀ 15-12-31 Āsifābād 1,200 ft.

Iris brown; bill brown, lower mandible yellow; mouth yellowish flesh-colour; legs & feet yellowish-brown; claws brown; soles yellow.

[A very slight extension of range, the southern fringe of its known winter range being previously the localities Mahābleshwar, Ahmednagar, S. E. Berār and Parāsgaon, Bastar.—H.W.]

Winter visitor. Met with singly in tall trees in deciduous forest. The note usually uttered is a finch-like *pink-pink*.

Phylloscopus inornatus humei (Brooks). Hume's Willow-Warbler.

Reguloides humei Brooks, S.F., vol. vii (1878), p. 131—N.W. India.

The Sparrow Collection contains a specimen labelled: ♀ 3-11-12 Medchal, Deccan.

Phylloscopus nitidus nitidus Blyth. The Green Willow-Warbler.

Phylloscopus nitidus Blyth, J.A.S.B., vol. xii (after November 13) 1843, p. 965—near Calcutta.

Specimen collected: 47 ? (imm) 7-10-31 Manānūr 2,000 ft.

Iris dark brown; bill, upper mandible horny-brown, lower mandible pale flesh-colour; mouth bright lemon yellow; legs, feet and claws pale horny-brown; soles lemon yellow.

Phylloscopus nitidus viridanus Blyth. The Greenish Willow-Warbler.

Phylloscopus viridanus Blyth, J.A.S.B., vol. xii (after November 13) 1843, p. 967—near Calcutta.

Specimens collected: 69 ♂ 9-10-31, 78 ? (imm) 10-10-31 Manānūr 2,000 ft.; 416 ? 3-12-31 Narsampēt 800 ft.; 623 ? 1-4-32, 640 ♂ 3-4-32 Utnoor 1,250 ft.

In the Sparrow Collection there is the following additional material from Hyderābād: ♀ 2-11-10, ♂ 3-11-10, ♀ 9-11-12 Trimulgherry.

Iris brown; upper mandible horny-brown, lower mandible pale flesh-colour or pale yellow; mouth lemon yellow; legs and feet greyish or greenish-brown; soles lemon yellow.

Winter visitors. First noted 30 September (Hyderābād City); last 12 April (Nīrmal).

Both these subspecies are certainly the commonest of the migratory warblers that visit the Dominions during the winter months—to judge from the specimens—the latter, *viridanus* being the more abundant of the two. They frequent secondary and deciduous forest keeping mostly to the foliage of the taller trees where they move about with surprising energy in search of insects lurking amongst the leaves and blossoms. Some of their habits closely resemble those of a flycatcher while others, such as clinging to sprigs upside down, are distinctly tit-like. They have a perky, penetrating *chiwee* call which is repeated at intervals of a few seconds. At Pāloncha—and also elsewhere—these warblers were often observed amongst the localised forest associations. Usually they are met with singly.

In No. 47 the skull was imperfectly ossified and the specimen was very fat. Nos. 623 (1 April) and 640 (3 April) were also fat and from this and the condition of their moults it was apparent that they were getting ready to emigrate shortly.

Phylloscopus magnirostris Blyth. The Large-billed Willow-Warbler.

Phylloscopus magnirostris Blyth, J.A.S.B., vol. xii (after November 13) 1843, p. 966—near Calcutta.

Specimen collected: 50 ♂ (imm) 7-10-31 Manānūr 2,000 ft.

Iris brown; bill horny-brown, commissure and base of lower mandible paler; mouth bright yellow; legs and feet pale horny-brown; soles lemon yellow.

Obtained from a tall tree in deciduous forest. Single. The skull was imperfectly ossified and the bird was very fat.

Phylloscopus occipitalis occipitalis (Blyth). The Large Crowned Willow-Warbler.

Phyllopneuste occipitalis Blyth, J.A.S.B., vol. xiv (after August) 1845, p. 593—S. India (—Nellore).

Specimens collected: 435 ? (imm), 436 ♀ 7-12-31 Pākhāl Lake 800 ft.

Iris brown; bill orange-brown, lower mandible pale orange; mouth pale orange; legs and feet slaty-brown; soles lemon yellow.

Shot from a party of 5 or 6 in a lofty tree overhanging a stream in dense forest by the lake. The birds were flitting restlessly from sprig to sprig, clinging upside down on the leaves or making short graceful sallies after winged insects. The flycatchers *Culicicapa ceylonensis* and *Hypothymis azurea* and the tits *Parus* and *Machlolophus* were other members of this association.

Prinia socialis socialis Sykes. The Ashy Wren-Warbler.

Prinia socialis Sykes, P.Z.S., 1832 (April.) p. 89—Dukhun.

Specimens collected: 83 ♂ 11-10-31 Manānūr 2,000 ft.; 234 ♂ 3-11-31 Borgampād 160 ft.; 570 ♀ 18-3-32, 593 ♂ 22-3-32 Kaulās 1,300 ft.; 669 ♀ 8-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Hyderābād City and Environs, Narsampēt, Mūkhēr.

Iris rich orange-brown; eye-rim ditto; bill black; legs and feet brownish-yellow or brownish-flesh colour; claws dusky. Mouth, summer plumage (Nos. 83 and 234) black; winter (Nos. 570, 593 and 669) brown, blackish-brown or slaty-pink.

The Ashy Wren-Warbler is commonly distributed throughout the Dominions but was noted as absent at Kannad and Bhāmarvādi (16-26 April, 1932) although *Prina inornata* seemed to be fairly common there. At Mūkhēr it was less numerous than *P. inornata*, while in the neighbourhood of Utnoor it was by far the more abundant of the two. It is a familiar bird in Hyderābād City and Environs and there is hardly a garden where a pair or two are not in evidence. It also inhabits open scrub jungle and the outskirts of cultivation.

Breeding: On 18 October (1928) I took a nest with 3 fresh eggs at Saifābād (Hyderābād City). On 28 September (1931) a nest was seen at Khairatābād (Hyderābād City) containing 3 young, five or six days old. Their mouths were a conspicuous bright orange-yellow. The testes of both Nos. 83 (11 October) and 234 (3 November) were enlarged to breeding size and the birds were warbling excitedly from exposed perches. On 23 October (1931) in the same garden at Saifābād a pair of Ashy Wren-Warblers were observed feeding and fussing over a full-fledged young Plaintive Cuckoo (*Cacomantis merulinus*) whose open gape was capacious enough to accommodate the entire head and neck of the foster-parents as it was inserted with food! Mr. R. K. Burnett (Stuart Baker, P.Z.S. 1923, p. 287) discovered the extraordinary fact that this Cuckoo parasitizes the nests of the Ashy Wren-Warbler in Hyderābād City, while a few miles outside the common fosterer is the Tailor Bird (*Orthotomus sutorius*). Mr. Burnett collected a fine series of eggs to show the remarkable resemblance of the cuckoo eggs to those of *P. socialis* in Hyderābād City and to those of *O. sutorius* in the surrounding areas.

In Hyderābād, the breeding season is chiefly the latter part of the monsoon, though at Trimulgherry Col. Sparrow obtained eggs mostly between 21 June and 24 August. I have seen both types of nest, viz. the Tailor-Bird type and the oblong purse of woven fibres. The type of structure evidently depends upon the nature of the available nesting site as Vidal records (J.B.N.H.S., viii, 427) the two different types of nest made by one identical pair in Poona.

According to Davidson and Wenden (S.F., vii, 83) this warbler nests in

August in the Bhīma Valley, while Butler took eggs in Belgaum in July and August (N. & E. i, 293). In the neighbourhood of Bombay I have taken nests in August, September and October.

The plumages and races of this and the following Wren-Warblers have been fully discussed by Mr. Whistler in the Eastern Ghats Report, J.B.N.H.S., vol. xxxvi, p. 573.

Prinia sylvatica sylvatica Jerdon. The Jungle Wren-Warbler.

Prinia sylvatica Jerdon, Madr. Jour. Lit. Sci., vol. xi (1840, January) p. 4—Seegore Pass of the Nilgiris.

Specimens collected: 4 ♂, 9 ♀ 25-9-31, 18 ♂ 27-9-31 Hyderābād City Environs 1,800 ft.; 346 ♂ ((imm) 20-11-31, 372 ♀ 25-11-31 Pāloncha 300 ft. and 1,100 ft.; 453 ♂ 12-12-31, 473 ♂, 474 ♂ (imm) 15-12-31 Āsifābād 1,200 ft.; 597 ♂ 23-3-32 Kaulās 1,350 ft.; 636 [♀] 3-4-32 Utnoor 1,250 ft.

Iris: ♂ orange; ♀ orange-straw, straw or drab; juv. olive-brown.

Bill: horny-brown, lower mandible pale flesh in juv.; ad. ♂ summer black; in other stages horny-brown, lower mandible fleshy; in juv. lower mandible bright yellow, gape pale yellow.

Mouth: ad. ♂ summer black; in other stages brownish pink.

Legs and feet: fleshy- or pale fleshy-brown; claws similar or darker.

[Distribution not very well known but there are specimens from Nāsik (Davidson) and Mahābleshwar (Hume Coll.) in the British Museum.—H.W.]

Generally distributed in Hyderābād but I failed to meet it on the Amrābād Plateau or at Kannad or Bhāmarvādi. It haunts boulder-hillock and scrub country and also scrub jungle on the edge of forest.

Breeding: No. 4 (25 September) and 18 (27 September) were both warbling vociferously though the pulpy condition of their enlarged testes suggested that they had probably finished breeding. The imperfectly ossified condition of the skulls of 346 (20 November) and 473 and 474 (15 December) showed that they were young of the year, born in the latter part of the monsoon. Col. Sparrow found it breeding commonly in the grass jungles in the neighbourhood of Trimulgherry where he took eggs between 11 July and 20 September, mostly July and August.

In the Rāipoor District (Central Provinces) according to Blewitt (N. & E., i, 299) it breeds from the middle of June to the middle of August.

At Panchgani, 4,400 ft. (Western Ghats) I have taken eggs in June.

Prinia inornata inornata Sykes. The Indian Wren-Warbler.

Prinia inornata Sykes, P.Z.S., 1832 (July 31), p. 89—Dukhun.

Specimens collected: 45 ♀ 7-10-31 Manānūr 2,000 ft.; 205 ? 31-10-31 Borgampād 160 ft.; 508 ♂, 509 ♂ 5-3-32 Kandahār 1,400 ft.; 558 ♂ 16-3-32 Deglur 1,300 ft.; 571 ♂ 18-3-32, 580 ♂ 19-3-32, 608 ? 24-3-32 Kaulās 1,350 ft.; 645 ? 4-4-32, 684 ♀ 9-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Nelipāka, Narsampēt, Pākhāl Lake, Hanamkonda, Āsifābād, Aurangābād, Kannad, Bhāmarvādi, Hyderābād City Environs.

Iris orange-yellow or brownish-orange; bill horny-brown, paler at base of lower mandible; mouth pinkish, also pale pink or pale yellowish-flesh streaked with brown; legs and feet brownish-yellow; claws brown.

Generally distributed. Singly or in pairs, affecting hedges near cultivation, grassland or open scrub-and-boulder country such as obtains in the environs of Hyderābād City, Warangal and elsewhere on the Deccan Plateau. It is also very partial to date scrub and tussocks of rank grass on water-logged ground.

Breeding: On 12 October I found a nest—woven purse of fine grass strips—among grass stems in tall grass-and-scrub country at Manānūr. It was built about 2 feet off the ground and contained the usual 4 blue eggs with red blotches, apparently fresh. Other pairs also seemed very excited at this season and were presumably breeding. I do not know if the birds have a brood earlier in the year also, but the testes of No. 571 (18 March) clearly suggested such a possibility; they measured ca. 3×2 mm.

Col. Sparrow has taken eggs at Trimulgherry between 18 July and 9 October, but considers August-September as the best time for them. In the neighbourhood of Bombay and in the Konkan it breeds principally between August and October.

Both parents take part in building and in the care of the young.

FAMILY: ORIOLIDÆ.

Oriolus oriolus kundoo Sykes. The Indian Oriole.

Oriolus kundoo Sykes, P.Z.S., 1832 (July 31), p. 87—Dukhun.

Specimens collected: 304 ♀ 14-11-31 Nelipāka 160 ft.; 394 ♀ 30-11-31 Narsampēt 800 ft.

Elsewhere noted at: Hyderābād City and Environs, Achampet (Mahbūbnagar District), Kāzipet, Borgampād ('commoner than *xanthornus*'), Pāloncha, Āsifābād, Kandahār, Mūkhēr, Utnoor ('fairly common').

Soft parts: No. 304 Iris crimson; bill flesh-pink; mouth pink; legs and feet slaty-blue; claws dusky. No. 394 Iris brown; bill horny-brown, slightly paler on lower mandible; mouth pink; legs and feet slaty-blue; claws brown. The above differences may be accounted for by the fact that No. 304 is presumably a two-year old bird while 394 is a first winter example.

[The possibility must be borne in mind that this Oriole is probably both a resident and a winter visitor to Hyderābād. The vast numbers that breed in Turkestan, Kashmir and the Punjab are summer visitors only and presumably winter somewhere in the Peninsula. In N. Kanara (Davidson, J.B.N.H.S., xi, 665) it is a cold weather visitor, being found in great numbers everywhere from November to the end of April. Not seen in the rains and believed not to breed.—H.W.]

The Indian Oriole is generally distributed in the State, frequenting groves of trees especially mango and tamarind, gardens and all well-wooded localities. It is also often met with in deciduous forest where I observed it as a member of the localised associations. The note most commonly uttered is a harsh *chee-ah*. In the Nāndēr District when mango trees were in flower, it was invariably to be seen hunting the attendant insects, and was also a constant visitor to the blossoms of *Erythrina indica* and *E. suberosa* for the nectar. It was commonly observed feeding on the figs of the Peepal (*Ficus religiosa*).

Breeding: The ovaries of the specimens were in an undeveloped condition. Col. Sparrow, who describes it as a common resident about Trimulgherry, took eggs between 25 June and 21 July, but found that most clutches had hatched by mid-July.

According to Davidson and Wenden (S.F., vii, 837) it breeds in the Bhīma Valley, where it is common, in June and July.

Oriolus xanthornus maderaspatanus Franklin. The Indian Black-headed Oriole.

Oriolus maderaspatanus Franklin, P.Z.S., 1830-1831 (October 1831), p. 118—Vindhyian Hills between Benares and Gurra Mandeli on the Nerbudda.

Specimens collected: 107 ♂, 108 ♀ 12-10-31 Manānūr 2,000 ft.; 146 ♂ 16-10-31 Farāhābād 2,800 ft.

Elsewhere noted at: Hyderābād City and Environs, Kāzipet, Borgampād, Nelipāka, Pāloncha, Utnoor ('fairly common').

♂ ad. Iris blood red; bill and mouth livid pink; legs and feet slaty-brown; claws black. In No. 108 (1st Winter ♀) bill black; mouth pale pink.

[The division of the Black-headed Oriole into three races in India and Ceylon and the reason for the adoption of this name have already been discussed in the E. Ghats Survey Report (J.B.N.H.S., vol. xxxvi, p. 584). I have also explained there that the *New Fauna* has wrongly attributed to the adult female—which in fact has a completely black head, throat and breast like the adult male—the plumage of the first-year birds in which the male and female are alike with streaked chin, throat and breast (vide specimen No. 108).—H.W.]

I failed to come across this bird in the Nāndēr and Aurangābād Districts although in the former at any rate, *kundoo* appeared to be common. While frequenting gardens and groves like the foregoing species, my impression is that it prefers more densely wooded country. I met it oftener in deciduous forest, especially when in leaf after the monsoon, and there also frequently among the localised associations. Its food consists largely of *Ficus* fruits, particularly the small Peepal figs.

The organs of the specimens were in a quiescent state,

FAMILY: STURNIDÆ.

Pastor roseus (L.). The Rose-coloured Starling.

Turdus roseus Linnæus Syst. Nat., ed. x (1758), p. 170—Lapland.

Specimens collected: 373 ♀ (imm), 374 ♀ (imm) 25-11-31 Pāloncha 300 ft. First met 26 October (Kāzipet); last 14 April (Aurangābād).

Iris brown; bill horny-brown, yellow at gape and basal half of lower mandible; mouth bright lemon yellow with gullet livid pink in 373 and greyish pink in 374; legs, feet and claws horny-brown.

Both specimens are approximately the same age and are the same sex, so the difference in gullet colour may possibly be only individual, or else depending upon one bird being somewhat more advanced in age than the other. They are immature, having imperfectly ossified patches in the centre of their skulls, and evidently on their first migration.

A very common and abundant winter visitor to every part of the Dominions, attending on grazing cattle, especially on water-logged ground, and feeding largely on fruits of *Zizyphus œnoplia* and *Bridelia hamiltoniana*, besides Fici of many kinds, of which they act as important dispersal agents. They are a serious menace to the ryot and in jowari-growing areas the damage they cause to the crops is enormous. In the Nāndēr District I often saw numerous flocks of three or four hundred birds each, looking like locust swarms at a distance, descending upon the ripening grain at all hours of the day. In the heat of the day the flocks retire into the surrounding Babool trees and spend the intervals between their intermittent ravages in chattering. I commonly found them roosting with *Psittacula krameri, Acridotheres tristis* and *Temenuchus pagodarum* in patches of *Butea frondosa* bushes. Smaller flocks may be regularly seen on trees of *Erythrina indica*, *Bombax malabaricum*, and *Butea frondosa* feeding on nectar from the flowers, and as I have shown elsewhere (J.B.N.H.S., vol. xxxv, p. 577 *et seq.*) it is more than likely that they are important agents in the cross-pollination of these species.

The Rosy Pastor is one of the birds whose economic status in India needs to be accurately determined, as to compensate for the loss it causes to the ryot directly, it destroys locusts on a large scale and is also beneficial in a number of other ways to agriculture and vegetation.

An excellent account of the breeding biology of this species in Russian Turkestan, whence a great many of our winter visitors presumably come, will be found in the Journal für Ornithologie, vol. lxxix (1931), pp. 29-56.

Sturnia malabarica malabarica (Gmelin). The Grey-headed Myna.

Turdus malabaricus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 816—Malabar Coast.

Specimens collected: 328 ♀ 16-11-31 Nelipāka 160 ft.; 447 ♀ 8-12-31 Narsampēt 800 ft.

Iris china white or greyish-white; bill, upper mandible lemon-yellow, greenish at base, lower mandible grey at base passing into greenish-yellow and terminating in bright lemon yellow; mouth pale slaty pink or slaty-blue; legs, feet and claws brownish-yellow.

[Not obtained by Col. Sparrow. I suspect that this bird may be a migrant in the Dominions as in Belgaum (Butler, S.F., ix, 238) and Madras (Dewar, J.B.N.H.S., xvi, 488) it is said to be a winter visitor only.—H.W.]

This bird (winter visitor ?) appears to be patchily distributed, as besides the above two localities it was not noted elsewhere. It was not common at either place, though more so at Nelipāka than at Narsampēt. Small flocks were observed in company with *A. tristis* and *T. pagodarum* feeding largely on the ripe black drupes of *Zizyphus œnoplia*.

The flight is exactly like that of *Sturnus* or *Pastor*.

The ovaries of the specimens were undeveloped.

Temenuchus pagodarum (Gmelin). The Black-headed Myna.

Turdus pagodarum Gmelin, Syst. Nat., vol. i (1789), p. 816—Malabar.

Specimens collected: 46 ♂ 7-10-31 Manānūr 2,000 ft.; 208 ♀ 1-11-31 Borgampād 160 ft.; 646 ♂ 4-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Hyderābād City and Environs, Farāhābād, Nelipāka, Pāloncha, Narsampēt, Āsifābād, Kandahār, Kaulās, Kannad, Bhāmravādi.

Iris bluish-white or yellowish cream colour; bill, basal half including gape and nostrils greenish lead colour, terminal half lemon yellow; legs, feet and claws lemon yellow; mouth greenish plumbeous or bluish-slate.

[This species has no races. Col. Sparrow's collection has specimens dated October, November, April and May from Trimulgherry, and Col. H. R. Baker collected specimens at Aurangābād in March and August. It seems to be very common and generally distributed and resident in the Peninsula.—H.W.]

The Black-headed Myna is generally and abundantly distributed throughout the State but was noted by the Survey as being much more numerous in the Eastern portions of area than in the Western (i.e. Aurangābād and Nāndēr Districts). It frequents every type of country, being specially partial to water-logged ground where it may be seen following grazing cattle in company with *A. tristis* for grasshoppers and other insects. Besides insects, its food largely consists of *Ficus*, *Zizyphus*, *Bridelia* and other fruits and berries while it is also extremely fond of the nectar of *Bombax*, *Butea* and *Erythrina* flowers, pollen of which I have frequently found adhering to the throat feathers. It also feeds to a considerable extent on Mhowa (*Bassia latifolia*) flowers and is at times destructive to ripening jowari crops.

Breeding: By the beginning of March the birds had begun to pair off. Between 1 and 10 April I constantly observed pairs prospecting for nesting sites in tree-holes in the deciduous forest at Utnoor, and the males were then in full 'song'. The testes of No. 646 (4 April) measured ca. 5×3 mm., and the bird—one of a pair—appeared to be preparing to breed. On 11 June (1928) Mrs. Tasker observed a full-fledged chick being tended by its parents at Begumpēt (Hyderābād City Environs). At Trimulgherry, Col. Sparrow has taken eggs between 10 May and 17 June.

According to Davidson and Wenden (S.F., vii, 85) the breeding season at Satāra is May, while at Panchgani (4,400 ft.) in the Western Ghats I found June to be the month most favoured.

Acridotheres tristis tristis (Linn.). The Common Myna.

Paradisea tristis Linn., Syst. Nat., xii ed., vol. i (1766), p. 167—Philippines *errore*, India.

No specimens collected.

Noted at: Hyderābād City and Environs, Jedcherla, Achampēt, Manānūr, Farāhābād, Singarenni Collieries, Borgampād, Nelipāka, Pāloncha, Narsampēt, Āsifābād, Kandahār, Mūkhēr, Deglūr, Kaulās, Utnoor, Aurangābād, Kannad, Bhāmarvādi and elsewhere.

The Sparrow Collection contains 4 specimens from Trimulgherry.

A very common and familiar resident all over the Dominions, both in and around towns and villages as well as away from human habitations. On the whole, however, it is more partial to open cultivated country than to forest. In some localities it is a serious menace to the ryot and does enormous damage to ripening jowari crops. Its food consists largely of locusts, grasshoppers and other insects besides *Ficus* figs, drupes of *Zizyphus* and many other species in the dispersal of whose seeds it plays an important part. The fleshy flowers of the Mhowa tree are also eaten.

Mynas are amongst the most regular visitors to the blossoms of *Bombax*, *Butea* and *Erythrina* and in the flowering season the throat and forehead feathers of the birds may be invariably seen coated with pollen from them. They have regular roosts (in *Opuntia* brakes, *Butea* patches etc.) to which thousands repair to roost night after night. The din of their bickerings before they finally settle down for the night may be heard for over half a mile. Their numbers here are usually augmented by Pastors, Parakeets and Black-headed Mynas, all of whom contribute to the noise. At Utnoor, hundreds of these birds collected to drink every evening before dusk on the grassy edge of a tank near the village, whence they retired in parties and flocks to roost as it grew darker.

Breeding: On 26 April several pairs were observed nesting (presumably) in holes in the scarp of rock at the back of Kailāsa Cave, Ellora. At Trimulgherry Col. Sparrow obtained eggs between 13 June and 1 July. In the Bhīma Valley the breeding season is May and June (Davidson and Wenden, S.F., vii, 84), the same as I have found it to be in the Konkan (Kolāba District).

Sturnopastor contra contra (Linn.). The Indian Pied Myna.

Sturnus contra Linn., Syst. Nat., ed. x, vol. i (1758), p. 167—India.

Specimens collected: 188 ♂ 29-10-31 Borgampād 160 ft.; 286 ♂ 10-11-31 Nelipāka 160 ft.

Iris brownish-orange or orange-buff; orbital skin orange; bill, basal portion orange-red, terminal pale flesh colour; mouth leaden-black; legs and feet yellowish-brown.

[More specimens of this species are badly wanted. The two races given in the *New Fauna* as *contra* and *dehræ* appear to be satisfactory if only the material in the British Museum is consulted, but they are not substantiated by the small amount of other material which I have been able to examine. These two Hyderābād birds are quite indistinguishable from Duars birds (upper parts black; white of lower plumage with a pearly grey tint) which are *S. contra contra*, though by distribution Hyderābād birds should be *S. c. dehrae* —H.W.]

The Pied Myna appears confined to the eastern portions of the State only. Apart from the localities whence the specimens were obtained, it was only met with in any numbers at Pāloncha. At Narsampēt (8 December) a single pair was noted in company with *A. tristis* and *T. pagodarum* and no more thereafter.

At Borgampād and Nelipāka where it was not uncommon, it was observed to keep almost exclusively in the immediate vicinity of villages, being especially partial to cattle enclosures or pens. In places where two villages lay a mile or two apart, practically none would be seen in the intervening country though the birds would be numerous in both villages.

This Myna has a number of pleasant musical notes, some of which are rather similar to snatches from the flight-song of *Eremopterix* and *Ammomanes* larks.

The testes of the specimens were in an undeveloped condition.

(*To be continued*).

OBITUARY.

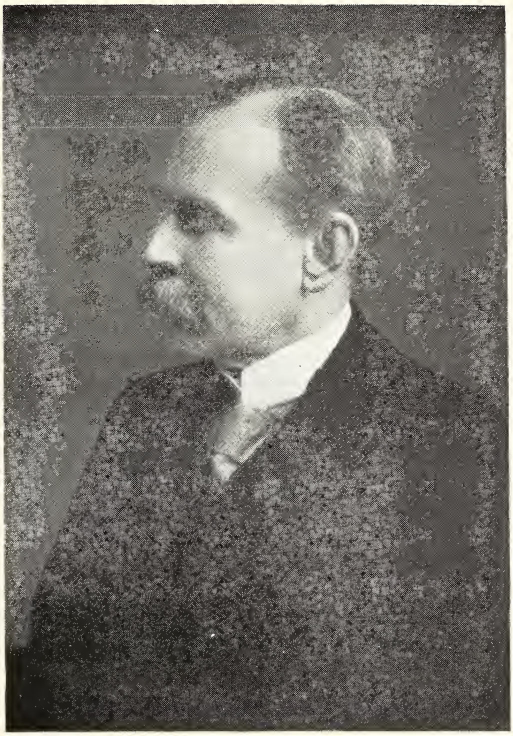
Lt.-Col. A. W. Alcock, c.i.e., f.r.s., 1859-1933

The sad and sudden death of Lt.-Col. A. W. Alcock, c.i.e., m.b., ll.d., f.r.s., i.m.s. (Retd.), on March 24, 1933, will be deplored by his large circle of friends and admirers throughout India.

Alcock was educated at Millhill, Blackheath, and Westminster, and after graduating as a Zoologist served for about two years as an Assistant Professor of Zoology in the University of Aberdeen under Professor H. A. Nicholson, f.r.s. He passed the competitive examination for the Indian Medical Service and came out as a Lieutenant in 1885 to this country where he had spent several years previously, first as a teacher of Classics in Darjeeling and later as an assistant on one of the plantations in Bihar. He served as a medical officer with the Punjab Frontier Force from 1886-88, and was then selected for the post of the Surgeon-Naturalist to the Marine Survey of India. In 1892 he served for a short period as the Deputy Sanitary Commissioner, Bengal, but on the retirement of Mr. J. Wood-Mason, Superintendent of the Indian Museum, in 1893, he was appointed to succeed him and served in this capacity till his retirement from service in 1907. He also acted as the Professor of Zoology in the Medical College, Calcutta, during his tenure as the Superintendent of the Indian Museum. In 1895 he accompanied the Pamir Boundary Commission as a Naturalist and did extremely valuable biological work in the little-known areas visited by the Commission. After his retirement from India he worked as a Lecturer in Medical Entomology in the London School of Tropical Medicine and in 1919 was appointed the Professor of Medical Zoology in the University of London. He retired from the latter post in 1924.

Col. Alcock's work as a Zoologist, as a Museum Administrator, and his connection with the pioneer literary and scientific society in India—the Asiatic Society of Bengal—deserve special consideration, and in the following paragraphs a short account of his activities in these lines is given.

Reference has already been made to his working as an Assistant Professor of Zoology in the Aberdeen University for about two years after graduation, but it was only after his appointment as the Surgeon-Naturalist to the Marine Survey of India that he began original research work in Zoology. Every year during the monsoon season when the Survey ship '*Investigator*' was laid up in the Bombay harbour, Alcock came to Calcutta and worked out, in collaboration with the authorities of the Indian Museum, the zoological collections made by him during the preceding survey season. His first zoological paper published in the *Journal of the Asiatic Society of Bengal* in 1890, dealt with the peculiarities of the gestation of Indian sharks and rays. During the next two years he extended his observations on this interesting phenomenon, and in



Lt.-Col. A. W. Alcock, C.I.E., F.R.S.
(Born 1859; died 24th March 1933).

collaboration with Wood-Mason published two papers in the *Proceedings of the Royal Society of London.* Two further papers on the same subject were published during the next two years in the *Annals and Magazine of Natural History.* It is impossible to include here a detailed account of his zoological contributions, but it may be noted that up to the time of his retirement in 1907 Alcock had published nearly fifty papers on marine zoology. His systematic papers include accounts of Anthozoa, Echinodermata, Brachiopoda, Mollusca, Crustacea and Fishes. Amongst these contributions those on deep-sea fishes and crustacea deserve special mention. The series of papers entitled 'Materials for a Carcinological Fauna of India' published in the *Journal of the Asiatic Society of Bengal* from 1895-1900 may be specially considered. These papers in which he critically treated most of the marine families of Brachyurous Crustacea, are a rich mine of information and are indispensible to every worker in Carcinology, and particularly to workers on Indo-Pacific forms. His Catalogues of Decapod Crustacea in the Indian Museum similarly contain very elaborate and carefully drawn up accounts of the rich crustacean fauna of Indian waters. After his retirement Col. Alcock published, in 1910, a very valuable monograph on the Potamonidae, or the freshwater crabs of India. In addition to the works mentioned above Col. Alcock published a number of papers on Viviparous Fishes, on an Instance of Natural Effect of Warning Colours, on the Toxic Properties of Saliva in certain Colubrine Snakes, on a New Flying Lizard from Assam, an Account of the Reptiles collected by the Afghan Boundary Commission, and on a New Apodous Amphibian from India; in the last paper is included a very learned discussion on the changes in the configuration of the various continents as deduced from the distribution of the limbless Amphibians.

In 1905 Col. Alcock developed a special interest in Entomology and, in collaboration with Capt. J. R. Adie, published a paper on the occurrence of a malaria-carrying Anopheles mosquito in Calcutta. On his appointment as Lecturer in Entomology in the London School of Tropical Medicine, Alcock not content with book knowledge only, started working out the different forms of insects which are of interest as disease-carriers, and in 1911 published his monumental work entitled 'Remarks on the Classification of the Culicidae, with particular reference to the Constitution of the Genus *Anopheles*' in the *Annals and Magazine of Natural History.* About the same time he performed an even greater service to tropical zoology by the publication of his wonderfully conceived and very lucid text-book entitled *Entomology for Medical Officers.*

As the Superintendent of the Indian Museum, Col. Alcock had to work under very disheartening circumstances, but he carried out reforms of an outstanding nature in the general management of the institution and did very valuable work in connection with the preparation and arrangement of the exhibits in the various public galleries under his charge. The exhibits which he set up in the galleries were mostly prepared with his own hands and are an ample proof of the time and care he bestowed on their preparation. As the Superintendent of the Indian Museum he tried to improve the administration of the Museum as a whole and I cannot do better than quote what his successor, the late Dr. Annandale, wrote regarding the condition in which he left the Trustees' office on his retirement: 'The admirable organization of his office, which enabled his successor to take up the threads of routine mechanically, is another matter for which it is impossible to be too grateful: although changes necessarily take place as the Museum grows and develops, the ground-work will always be that constructed by Col. Alcock, too often without recognition, and in spite of obstacles of which nothing was known beyond the Museum walls.' To popularise the Museum and make it possible for the lay public to understand the exhibits Col. Alcock wrote a series of very handy and interesting guide-books. These guide-books and the *Naturalist in Indian Seas* published in 1902 are outstanding examples of Col. Alcock's erudition and perspicuity, while the literary style of these books 'in which the strong infusion of Shakespeare and other Elizabethan authors is never pedantic, never frivolous, and never dull', adds to their charm.

No account of Col. Alcock's zoological work in India will be complete without a reference to his connection with the Asiatic Society of Bengal. He joined the Society in 1888 and continued as an active member till 1906 when he left India on leave preparatory to retirement. He was elected the Natural History Secretary of the Society in 1894, General Secretary in 1895, Vice-President in February 1901, and in 1911 was elected as an Honorary Fellow.

For his researches on the marine zoology of India he received the honorary degree of LL.D. from the University of Aberdeen in 1904, and was awarded the Barclay Memorial Medal by the Asiatic Society of Bengal in 1907. He was elected a Fellow of the Royal Society of London in 1901, and was a corresponding member of the Zoological Society of London, and of the Netherlands Zoological Society, and an Honorary Member of the California Academy of Sciences, Philadelphia. His services in the Indian Museum were recognised in 1903 by the grant of the title of C.I.E.

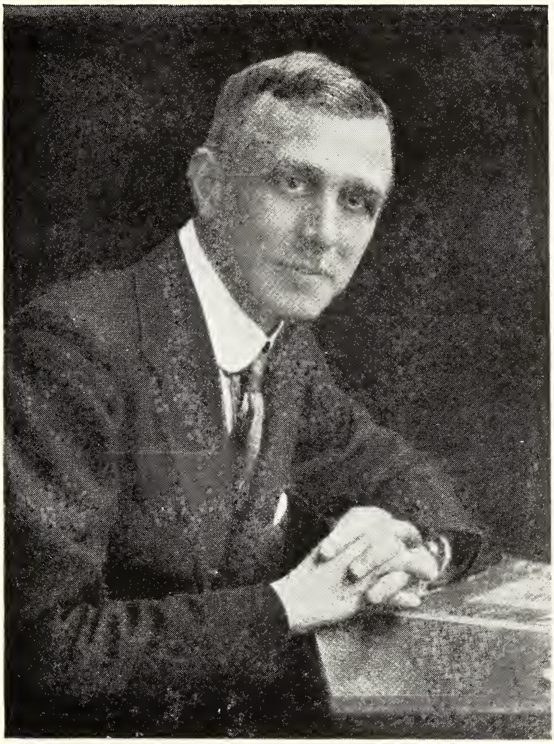
A list of his publications on Indian Zoology was published in the *Records of the Indian Museum*, vol. ii, pp. 4-9.

B. P.

LT.-COL. J. STEPHENSON, C.I.E., F.R.S.

Lt.-Col. John Stephenson, C.I.E., M.B., Ch.B., F.R.C.S., D.SC., F.R.S., F.R.S.E., I.M.S. (Retd.) died on 2nd February, 1933, of a heart attack in his 62nd year after a very distinguished career as a medical man, zoologist and educationist and as a student of Oriental literature.

Colonel Stephenson was born in 1871 at Padiham, Lancashire, and was educated at the Burnley Grammar School and the University of Manchester. In Manchester he had a very distinguished career in zoology and medicine. After qualifying as a doctor



Lt.-Col. John Stephenson, c.i.e., f.r.s.
(Born 1871; died 2nd February 1933).

Stephenson acted for a time as the House Surgeon in the Manchester Royal Infirmary and the London Hospital for the Diseases of the Chest till in 1895 he passed the competitive examination for the Indian Medical Service. For the first five years of his service in India he was on military duty and saw active service with the North-West Frontier Expedition of 1897. He was posted as a medical officer on plague duty in the Punjab in 1900, and up to 1906 served as a Civil Surgeon in Rawalpindi, Gujrat, Ambala and other places. Early in 1906 he went on leave and passed the Fellowship examination of the Royal College of Surgeons, London, with a view to appointment as Professor of Surgery in the Lahore Medical College. Fortunately for the study of zoology in India, the recent experiment of the transfer of the teaching of pure science subjects, like botany and zoology, from the Medical College to the Government College, Lahore, had not, for want of properly qualified teachers, proved the success that its initiators had hoped. The then Lieutenant-Governor of the Punjab, Sir Denzil Ibbetson, who was a personal friend of Colonel Stephenson, knew that Stephenson had studied zoology in Manchester under the famous professor A. Milnes Marshall, and knowing Stephenson's capacity as an organiser and worker, he prevailed on him to undertake the duties of the recently created professorship of biology in the Government College, Lahore. He held this position till 1912 when, in addition to being the Professor of Zoology, he was appointed Principal of the Government College, Lahore. He retired from service in India in September 1921, and went over to Edinburgh where he was appointed Lecturer in zoology in the University. In November 1929 he left Edinburgh for London and till shortly before his death he used to carry on zoological researches in the British Museum of Natural History as an unofficial worker.

On his appointment as Professor of biology in 1906 Stephenson, who had been out of touch with zoology for nearly eleven years, started earnestly to brush up his knowledge of the subject and bring it up to date. Though he had a fairly good teaching museum at his disposal there was neither a properly equipped laboratory nor any library worth the name in the Government College, Lahore. He was, however, able to get together before long a first-rate teaching museum, a very good working library and by 1914 had succeeded in having a new biological laboratory built for the institution in which he was working. As a result of his labours, zoological instruction in Lahore attained a very high standard in a few years and he was able to found a very productive school of zoology in the Government College. Several students from his laboratory, in whom he instilled the faculty of critical work and careful investigation from the very beginning, are now holding influential zoological positions throughout the country, and it was solely due to his initiative and interest that a really flourishing school of zoological research was established in Lahore. His tenure of office was marked by conspicuous success as a teacher, while his administrative qualities were responsible for making the institution under his charge into a really first-rate place of instruction. He also took a very active interest in the affairs of the Punjab University and in addition to serving for several years as the Dean of the Faculty of Science, he acted during the last year of his stay in India as the Vice-Chancellor of the Punjab University.

Stephenson was not content with teaching zoology only, but started research work in zoology soon after his appointment in Lahore and by 1909 had produced a thesis which earned for him the degree of Doctor of Science of the London University. His researches from the very beginning were concentrated on the Oligochaetes, and from 1907 onwards till shortly before his death he published numerous papers on Oligochaetes of India and other areas. The results of his systematic work on Indian Oligochaetes of India for over 16 years were collated in his volume on the Oligochaetes in the *Fauna of British India* series and since that date he was recognized as one of the two chief authorities on this group of worms. In 1929 he completed the masterly morphological and systematic monograph on the Oligochaetes which was published in 1930 by the Clarendon Press, Oxford. In addition to the systematic studies on the Oligochaetes he carried out researches of outstanding character on the intestinal respiration of Oligochaetes and worms in general, and published several very important morphological papers on the structure of these worms in the *Transactions of the Royal Society of Edinburgh* and the *Proceedings of the Royal Society of London*. His monograph on the Oligochaetes clearly indicates his extensive knowledge of the structure and classification of the Oligochaetes and a very thorough acquaintance with the literature on the subject. In addition he dealt in detail with such important questions as convergence, the polyphyletic origin of the various genera and families and the geographical distribution of earthworms. In connection with the distribution of these worms he discussed in detail the former existence of an Antarctic continent and land-bridges between India and Australia on the one hand and the Peninsular India and Africa on the other. He also published a very valuable account of the Nemertines of the River Clyde in the *Transactions of the Royal Society of Edinburgh*.

Stephenson was a great linguist and all his spare time was devoted to the study of early Arabic and Persian literature. Before his appointment as Professor of Biology in the Government College, Lahore, he had been working on the manuscripts of the Hakim Sanai's 'Hadiqatu-l-Haqiqat', and collated edition of these manuscripts, together with an English translation of the work was published by the Asiatic Society of Bengal in the *Bibliotheca Indica* series. Within recent years he published an English translation, with annotations of the *Nuzhatu-l-Qulub* in the publications of the Royal Asiatic Society of London.

For his work as an administrator and teacher Colonel Stephenson was awarded the title of C.I.E. in June 1919. His contributions to the advancement of knowledge were recognised by the award in 1920 of the Keith Memorial Medal of the Royal Society of Edinburgh and of the Barclay Memorial Medal of the Asiatic Society of Bengal in 1925. He was a Fellow of the Royal Society of Edinburgh, and the Asiatic Society of Bengal, and received the blue ribbon of science on his election as a Fellow of the Royal Society of London in 1930. He was appointed Editor of the *Fauna of British India* series in May 1928 in succession to the late Sir Arthur Shipley and since 1931 he worked as the Zoological Secretary of the Linnean Society of London.

Colonel Stephenson was a very brilliant teacher and eloquent lecturer: those who had the privilege of attending his lectures will never forget the care and pains he took in making the subject of his lectures as interesting and instructive as possible. He was a sincere and loyal friend and all his friends will miss him for his sound judgment and ever-ready help in all matters relating to education and more particularly to the advancement of zoology in India. His extensive circle of friends feel his untimely death as a personal bereavement and extend their heart-felt condolence to Mrs. Stephenson in her irreparable loss.

B. P.

REVIEWS

THE FAUNA OF BRITISH INDIA, INCLUDING CEYLON AND BURMA. ODONATA. Vol. I. By Lt.-Col. F. C. Fraser, I.M.S. (Taylor & Francis.)

Col. Fraser, the author of the first volume on the Odonata or Dragonflies of India in the 'Fauna' series, is well known to the readers of the Journal of the Bombay Natural History Society, as since 1918 he has published a series of over forty very well-written and beautifully illustrated papers on these insects in this Journal. The present volume, the first of the series, is not, as the author modestly suggests in the introduction, merely a compilation from his previous accounts, but is an entirely new work based on an examination of the old and well-known European collections and the extensive collections made by the author himself and his friends and colleagues in almost all parts of India.

In all about 90 genera and 500 species of Dragonflies are known from the Indian limits and in the present volume 39 genera and 168 species and subspecies of the suborder Zygoptera are critically treated. In the introductory part the author has given a concise but very comprehensive account of the biology, ecology, methods of collecting, preservation and storage of the Dragonflies. This is followed by an account of the classification and structure of these insects. The very clear illustrations of the wings and the detailed comparative account of the terminology of the venation according to the Selysian, Comstock-Needham and Tillyard's Notation should make it possible for even the uninitiated to understand the structures without any difficulty.

The descriptions of the various species, which are very detailed, are based on well-preserved specimens and often on examination of fresh material. As a result of his examination of large series of individuals from different areas, several of the so-called species were found to be only colour varieties or, at the most, local varieties or races, and in several cases the author has rightly used a trinomial nomenclature for some of the forms. The information about the location of the type-material of various species should prove very useful to future workers.

Owing to the sad and sudden death of the Editor and the volume having to be issued within the financial year a number of corrections and addenda and corrigenda failed to be sent in to the printers, and, as we are informed, the Glossary at the beginning was not as complete as the author would have liked it to be. Even with these omissions the work is up to date and will, it is hoped, be a standard work of reference on the subject.

The volume is well illustrated, the figures being true to nature and at the same time beautifully executed.

B. P.

The BOOK OF THE TIGER by Brigadier-General R. G. Burton. (Hutchinson & Co. Ltd., Publishers, London.)

General Burton in his preface recognises the difficulty of writing a book on a subject which has been so exhaustively treated as the Tiger, inevitably therefore *The Book of The Tiger* contains much which has already been said, and apart from actual quotations, it is obvious the works of previous authors form a large foundation to the book under review; the author's own facts, experiences, observations and deductions being relatively less important, and seldom pressed. It is therefore by the extent of the reading of the author, and his selection from previous works, and the uses he makes of these selections that *the Book* must be chiefly judged. In doing this the Author has produced an exceedingly interesting volume, and moreover has approached the subject from an entirely new angle. The contents are not merely confined to tiger, as there are many dissertations on other animals and animals in general, covering the general theme of the Tiger as a background. It is natural to all authors writing about animals and their own experiences, to retail in detail anything extraordinary, or unusual, that may happen, rather than the ordinary, or normal; and in the quotations perhaps the former have been given rather too much prominence without a warning 'caveat' to the unexperienced reader on the lines, that humanity cannot be judged in terms of Dr. Johnson and Napoleon. The book therefore is essentially one for the reader who possesses previous knowledge of the subject, and it will be surprising if the author had not this in view, consciously or subconsciously, when he wrote it. As is to be expected when a large number of different authors at different times are quoted, contradictions appear and many of the controversial questions regarding tiger are raised and elaborated; but the author generally contents himself with summing up, leaving the verdict more or less open to the judgment of the reader: we wish that the author with his wide reading and great experience had pronounced judgment as well. An opportunity appears to have been missed of settling some points finally, whereas it is probable that the effect of the book may be to reopen the unprofitable discussion of points about which everything possible seems to have already been said. To all those who revel in speculation the book will have an irresistible appeal. Given below is a brief résumé of the chapters of the book with some comments on each, which struck your reviewer during their perusal.

The first Chapter is headed Prehistoric Types and discusses the sabre-toothed tiger, the ancestral type; general and particular structure: the 'prominent papillæ' on the tongue enabling the tiger 'to remove surface flesh from bones, and to keep itself clean' are referred to. We are told that cleanliness is a necessity for reasons of health, but in an effort to be original the author goes on to suggest as an additional reason, that cleanliness reduces the probability of detection by scent on the part of a prospective prey. Surely this theory borders on the fantastic, and cannot have been an operating cause in the habits of cleanliness.

The next Chapter deals with protective colouration, Races of Tigers, White and Black Tigers, and the well-known letter of Buckland *re* the Chittagong Tiger is referred to, but we are not told what the author's own views on the subject are. He arrives at the conclusion that the peculiar colouration of the tiger has been evolved to further concealment, but seems to have some unnecessary hesitation in the matter, as tigers in India hunt by night 'when colouration is of little or no service,' a statement which few will accept. We are elsewhere warned in the book against applying human standards to animals, a mistake which he appears to have made himself, as who can say what the powers of vision of animals are at night? Certainly very different from that of man, and the stripes may be of the greatest service in concealment by night as well as by day. I have a dog who is put to his kennel every night about 9 p.m.: the kennel is enclosed by a light wire-netting frame work: one of the panels is hinged. On the very darkest nights when one can see nothing, on rounding the corner of the house, the dog knows instantly if the panel is open or shut: if the former, he trots on ahead, if the latter, he stays by my heel. No one would select the dog as an animal particularly adapted for night vision.

Chapter III is devoted to discussing the size of tigers and we are given a large number of quotations belonging to the past. Recent claims are also referred to, notably the case of the two Viceroys: no mention is made of a claim from Bihar and Orissa, and another by a Mr. Seweli from Madras, which were made when the correspondence on the Viceroyal tigers was in progress: probably the author thought them unworthy of notice. One is left with the impression that the author does not believe in the animal of monstrous size and naturalists and sportsmen will be indebted to General Burton in the effect this chapter will have in keeping claims within bounds, and it happens to be most opportune, as rumour has it that 'the Disease' may again break out.

The next Chapter deals with Geographical Distribution and is of great interest, giving the reader much information about the early history of the tiger gleaned from the earliest writings, showing a knowledge and study of these, rarely possessed by the qualified Shikari. While agreeing with these authors in believing the tiger to be an immigrant from the North, General Burton predates its entrance to 5000 B.C. a conclusion based on the finding of a single coin on which a tiger's image is impressed. The fact that tigers are still intolerant of the Indian heat is not founded on fact. We are told:—'In tropical climates all animals are impatient of heat and thirst, and the young of all animals have thicker, longer and softer fur than they have in maturity;' an assertion that will not bear critical examination.

Chapter V deals with breeding and gestation. Cubs and Hybrids are discussed, and some interesting stories are related.

The author's actual experience has been that males exceed females in number but this is based on a census of the number of animals killed, and considers the sexes balance each other. Given a jungle to contain an equal number of both sexes the probabilities are that a shooting party would secure more tigers than tigresses: the bag therefore is an insecure basis in which to apportion the sexes: a census of the pug marks being much more reliable. For a number of reasons tigresses more often escape. It is significant that on page 194 General Burton refers to the cunning of two tigresses: if he refers to a tiger in this way I have overlooked it: and I should imagine that in most books on Shikar where elusive cunning is in question tigresses figure much more prominently than tigers. Under the chapter—Character and Habits—the variability of these is emphasised and illustrated both from the experiences of the author and with stories recorded by others: there are dissertations as the Wild Dog, Buffalo, Pig and Jackal. The curious Sambar-like call uttered by tigers is briefly referred to. One would have welcomed a more comprehensive treatment of this interesting subject, as well as other calls; and points not prominently mentioned in previous publications, and thus not featured by the author on his own authority. The Chapter on how tigers hunt is largely occupied with a discussion of the relative importance of scent, hearing and sight, and comparisons with the lion. Subsidiary reasons are given for his preference to hunting by night, but we might have been told as the main reason, that the animals he hunts are then on the move themselves, and are thus more easily hunted. The Chapter on Tigers and their prey discusses and summarises the tiger's method of killing, with quotations from past authorities on whom possibly too much reliance has been placed, as those men had not themselves seen a tiger kill, but asserted as fact what was merely conjecture, based on deductions from wounds, and what natives said. The Chapter concludes by describing how the tiger deals with his dead prey. Attention is rightly drawn to the almost incredible amount a hungry tiger will sometimes eat, 'perhaps 200 lbs or more of beef may be eaten at a sitting.' This far transcends our possibilities of belief. We are told elsewhere in the book that a good sized tiger is round about 400 lbs. What! eat half his own weight at a meal? This is one of the few original remarks and shakes our confidence. In discussing the length of tigers the author invites us to depict a 12-ft. tiger on the wall. In imagination and applying a similar process I propose, to model tiger from a lump of clay but half the mass of that clay has to be introduced somehow in the form of recently swallowed beef. The conception is utterly grotesque. A Chapter is devoted to man-eaters in which a number of jungle tragedies are related, followed by an account of some of the curious and past methods of hunting, and killing tigers. Hunting, on elephants and on foot are then dealt with on the usual lines. Mention is made of tigers being killed with one discharge of buck shot and we are then told 'The only other instance of two tigers being killed with one bullet is that recorded by Captain Forsyth who fired at one, and found that the bullet had killed another.' Colonel Pollock not only killed two at a shot, but a 3rd as well with the other barrel. Moreover it was done deliberately. In his *Reminiscences* he writes as follows.

'I waited until the two heads were close together and firing at the junction of the neck and the head I rolled over the two with one shot. It passed clean through both and my left barrel caught one of the youngsters (¾ grown) in the stern. The tigress was stone-dead, the tiger showed some signs of life, so I put an express bullet into his head. I had no difficulty in killing the third because she was unable to move, the conical bullet having entered high up on the buttock, traversed the body and gone out by the chest, smashing the fore quarter to atoms.'

There is a chapter on rifles and camp equipment, admitted by the author as being now possibly out of date, but the main principles are as true to-day as they were in the days when he hunted, viz.: to use a heavy bone smashing knock out weapon and to see that the willing co-operation of the local people is ensured by fair and considerate treatment. A very interesting chapter on

History and Literature follows to which a Bibliography is appended. It is to be regretted that E. D. Baker's book *Sport in Bengal* was not included, as no matter how select the list, Baker's book is worthy of an honoured place therein. What he wrote rings true, and his account of the Sandarbans is quite unique: it is hoped that in future editions the author will find a place for such a fine sportsman and writer.

The book concludes with a chapter on Myths and Superstitions and a chapter on the Indian Lion in which much interesting matter is quoted from authors who wrote when lions were still plentiful in India: the author makes no reference to the comparatively recent reports of lion in the Banda and Gonda districts. Further relating to the early 'sixties' no mention is made of the very interesting records of the Central Indian Horse at Goona, which show that quite a bag of lions could be secured in a season's hunting; then shortly after they suddenly and completely disappeared, as also happened from time to time over wide tracts: the author's views on the solution of this mystery would have been welcome: it is still a mystery. The book contains 16 illustrations, some of which are hardly relevant and rather poor.

A word to the reader of this review. The Bombay Natural History Society's *Journal* is a publication of a scientific or quasi-scientific nature, and an author who subjects his work to review by it, must expect a critical examination of what he wrote, as opposed to a more general survey common to ordinary publication. The reader is asked to bear this fact in view, as otherwise he might attach too much importance to a few out of a number of possible criticisms, and wrongly conclude that the book is of little value. It is far otherwise; General Burton has written an exceedingly informative and interesting book, unique of its kind and one of great difficulty.

Within comparatively recent years a vast change has taken place in what the public demands from the sportsman naturalist who decides to publish. The slipshod methods where effect was paramount to scientific accuracy will no longer suffice; this implies no blame to the past generations, or on those whose experience is drawn from that period; they are an expression of their times. Anyone who attempts to handle the vast material at the disposal of General Burton should possess an equal or greater knowledge of the subject he is handling on the lines of Modern thought and requirement, so far therefore as critical insight into what others had recorded within the past century regarding the characteristics and life history of the tiger is concerned the author is insufficiently equipped.

The work will rest on the author's excursions into ancient history, to which we wish he had devoted far more space; and had he done so the book might have justified its proud title.

A. A. D. B.

FAR-OFF THINGS by R. L. Spittel. C. A. C. Press, Ceylon, Rs. 8-50.

Dr. Spittel's new book is a fitting sequel to his first volume *Wild Ceylon*, a work with which all lovers of the wild places of Ceylon are familiar.

In his new book, Dr. Spittel devotes the first three chapters to an outline of the ancient history and folklore of the Island and then returns, in his next three, to his first love—the Veddas, the aboriginal wild men of the jungles of the Eastern and Uva Provinces.

Dr. Spittel is the acknowledged authority of these fast-disappearing people and his knowledge of their quaint customs and strange habits is unequalled. He writes with an intimate insight that is denied to others.

Members of the Bombay Natural History Society and Sportsmen and Naturalists in general, will however, most probably, find their greatest interest in the subsequent chapters on Elephants, the Devil Bird and Snakes. The Pannikyans or professional elephant noosers of Ceylon, whose methods Dr. Spittel describes in detail, are unique in their dangerous calling; their courage is of an exceptional quality and their knowledge of the ways of the elephants they capture is profound. In this chapter, also the author quite rightly condemns the cruelty of the Elephant Kraals, as conducted in Ceylon.

The identity of the Devil Bird, that much-discussed and elusive bird, has always been a matter of much interesting controversy and Dr. Spittel's chapter on it will be read with special interest. There would not seem to be any room for doubt that Dr. Spittel has proved, beyond question, the identity of the author of the ghastly cries, generally attributed to the Devil Bird, in the forests of the dry Low-Country but I do not find him so convincing when he attempts to maintain his theory that there is one and only one source of the Devil Bird's cry, both in the mountain forests as well as in the dry zone jungles. In the first place his Devil Bird, the Crested Hawk Eagle, is not generally found above 2,500 ft. whereas the Devil Bird's cries have been heard, by reliable observers, at altitudes of 5,000 ft. and over. Again there are at least two authentic instances of the Devil Bird having been shot while uttering his appalling cries and in both, the culprit was the Forest Eagle Owl.

The Forest Eagle Owl is uncommon but resident in the Hills as well as in the low lands and I, personally, am quite convinced that he is, on occasion, the author of the Devil Bird's cries. Readers of *Far-off Things* will, however, judge for themselves on the evidence put forward.

As an eminent Surgeon, Dr. Spittel's views on the hearing of snakes in relation to Snake-charming, will be read with more than usual interest and his account of the wiles of the Snake-charmers and of a fight between a large Cobra and a grey Mongoose will appeal to all on whom snakes exercise their fascinations.

The remaining chapters deal with 'far-off things' in far-off places in Ceylon jungles and are of equal interest with the preceding chapters.

The book is illustrated with sixty-five excellent photographs and drawings, of various subjects, and contains verse, which will appeal to the poetically inclined, as well as prose—I have only one criticism to make and that is that the author indulges in the unfortunate Ceylon habit of misnaming some of the wild beasts that he talks about; he calls the Langur Monkey the Ape, the Mouse-deer the Moosedeer and the Monitor lizard the Iguana.

W. W. A. P.

1. STORCHE: ERLEBNISSE MIT DEM SCHWARZEN UND WEISSEN STORCH. By Horst Siewert. Pp. 208. 80 Plates—Berlin: Dietrich Reimer Ernst Vohsen. 1932. Price RM 4.80.

To readers of the *Journal für Ornithologie* Horst Siewert requires no introduction. His excellent studies of the breeding-biology of various European birds notably the Spotted Eagle (*Aquila pomarina*) and more recently of the Goshawk (*Astur gentilis*) are examples of what indefatigable patience coupled with careful and intelligent observation can achieve in the way of getting an insight into the complex psychology of the breeding bird. To get an insight into its intricacies is one thing, however, and to be able to describe one's experiences in clear and precise language so as to pass on the fullest benefit of one's opportunities and labours to others is quite another. In both these Herr Siewert has proved himself to excel. In fact he goes a step further: in support of the written word he presents to his readers a remarkable pageant of pictures from his camera which for clearness and beauty can scarcely be rivalled. Many of them indeed are unique, and all of them are a pleasure to behold.

Such is the case with his book that now lies before us. It deals with two species of storks: the Black Stork (*Ciconia nigra*) and the White Stork (*Ciconia ciconia*), both winter visitors to India, about half the book being devoted to each species. Very little authentic and connected information existed in regard to the breeding-biology of the former, and Herr Siewert's complete and detailed account is a most valuable contribution to the subject. It describes the life-history of the birds—a nesting pair of which the author had under observation in East Prussia—from the time of mating right up to when the young were old enough to leave the nest. The observations recorded and the excellent camera studies were made from a hide built on a neighbouring tree almost on a level with the nest and represent something like a thousand hours' patient and unremitting labours!

Our knowledge of the breeding-biology of the White Stork has been more complete on account of its being such a common and familiar breeding species in Northern Europe, but it has been distinctly enriched by the very remarkable camera studies which accompany this part of the letterpress.

The book contains in all 80 full-page reproductions from the author's photographs, half of which are devoted to each species. To those at all conversant with modern printing costs it is astounding that such a profusely and beautifully illustrated book can be offered at the low price of R.M. 4.80 (about Rs. 3/10). The plates justify in every way the reputation for excellence they have earned for the author and are by themselves worth much more than the cost of the book. It is to be hoped that the book will have the wide circulation it deserves even with nature lovers not fortunate enough to read German.

S.A.A.

2. DER VOGEL SCHNARCH: ZWEI JAHRE RALLENFANG UND URWALDFORSCHUNG IN CELEBES. By Gerd Heinrich. Pp. 196; 63 Plates. Berlin: Dietrich Reimer/Ernst Vohsen. 1932. Price RM. 4.80.

This is the record of a two-years' expedition (March 1930—April 1932) in Celebes, financed by Dr. L. C. Sanford of the American Museum of Natural History, New York, and carried out by the author under the direction of Prof. Dr. Erwin Stresemann of the Berlin University Zoological Museum, to which institution half of the material collected is to go.

The expedition was sent out principally in search of the Flightless Rail [*Aramidopsis plateni* (Blas.)]—the 'Schnarch', or 'Snore', from its peculiar call—a species discovered in Minahasa (W. Celebes) some 40 years back and since then unheard of. Among its other important aims was to re-discover the Honey-eater (*Myza sarasinorum*) which was as yet known only from a single young bird brought back by Sarasin from the northern peninsula years ago.

How thoroughly and successfully Herr Heinrich was able to carry out the work entrusted to him is already well known to readers of the *Ornithologische Monatsberichte,* in several past numbers of which the preliminary results of the expedition have been published by Dr. Stresemann. Herr Heinrich has to his credit two entirely new genera of Ground Thrushes, namely *Heinrichia* and *Geomalia*, besides numerous other novelties in the way of species and subspecies. Among some of his very interesting acquisitions, besides the principal, *Aramidopsis plateni,* which was secured in a dramatic manner towards the close of two years' rigorous search, were complete specimens of the rare and chiefly terrestrial Woodcock (*Scolopax celebensis* Ril.) in the Latimodjong Mountains and of *Habroptila wallacei,* another rare and flightless rail in Halmahera. The former was originally named and described by an American naturalist many years ago merely from a wing and pieces of the skeleton, and the specimens now obtained by the expedition represent the only complete examples known to science.

The vast amount of material collected is being worked out at the Berlin Museum, and will naturally take a long time to examine thoroughly and report on, but when finished we have no doubt it will form the most complete work on the birds of these interesting islands.

The vicissitudes of the expedition during the time it was in the field are graphically described. Impenetrable cane-brakes, swamps, leeches, cloudbursts and swollen streams, all the indispensable adjuncts of tropical forests, find their proper place and help to convey to the sit-at-home reader some idea of the hardships and discomforts under which the work of an expedition of this nature, with financial limitations, has to be carried out.

The author was accompanied by his wife and sister-in-law who between them were mainly responsible for the preparation of the skins. We cannot sufficiently admire the pluck of these two women to whom much credit for the success of the expedition must go.

Herr Heinrich has not only given us a most graphic and readable account of the work, difficulties and achievements of his expedition but he has also supplied us with much valuable and interesting information of a general nature concerning the country, its people, their customs and so on, and also in regard to much of the indigenous fauna outside the scope of his immediate enquiry.

The book contains 63 excellent reproductions of the author's photographs depicting the country, its inhabitants human and otherwise and various aspects of the activities of the members of the expedition.

S. A. A.

'WHAT BUTTERFLY IS THAT?' by G. A. Waterhouse. Cloth 8¾×6¾×1½: 291 pages: 25 coloured plates of butterflies: 9 uncoloured plates of early stages: 4 text-figures. Published December 1932 by Angus and Robertson, Sydney for 12 shillings and 6 pence and obtainable in London from the Australian Book Company, 16 Farringdon Avenue: E.C. 4.

The object of the book is to enable collectors in Australia to identify their captures easily and to encourage them to fill in gaps in existing knowledge. The introduction (pp. 1-23) describes in simple language—the position of the butterfly in nature—the life history—structure—classification—variation—and distribution. For each subfamily there is a short introductory chapter, followed by a chapter for each coloured plate. Within the 'plate' chapters the butterflies are numbered as in the plate, followed by:—

The Trivial name;

The Latin generic and specific name, followed by the name of the describer and the year of publication;

The Distribution;
Short Description;
Brief life history, where known.

Notes on habits and other matters of interest; each subspecies being dealt with separately. The book closes with a chapter on collecting (times and places) and on collecting apparatus: there is a good index.

This is a most fascinating book and fulfils its purpose in an ideal manner. The title and the gaudy paper cover, depicting the Priamus Birdwing seated in a red query sign, strike a somewhat frivolous note, but the subject matter is complete, accurate and up-to-date, as was to be expected from the pen of Dr. Waterhouse, the leading expert on Australian Butterflies. The coloured plates have been beautifully executed by Mr. Neville Cayley and perfectly reproduced: the figures of the larger butterflies have been reduced to half size, but the detail is so clear and accurate that identification presents no difficulty whatever. The reviewer was sent proof copies of the plates depicting the skippers by Dr. Waterhouse and was able to assign the correct name in every case without any hesitation. Every butterfly is figured, upperside and underside, as well as both sexes, subspecies and varieties, where the differences are remarkable. The short descriptions fulfil every requirement, while there are no references, synonyms or technical terms to deter amateurs.

Our Society may take credit for the fact that Dr. Waterhouse has utilised the introduction to a certain extent as well as many of the trivial names contained in their own publication—*The Identification of Indian Butterflies.* The excellent coloured illustrations have, however, enabled Dr. Waterhouse to dispense with complicated keys. It is to be remembered that compared with Australia, there are over four times as many species of butterflies in the Indian Empire, so that a similar work for India would run to four volumes. The cheapness of the book is surprising and indicates the very high standard reached in Australia.

Only two minor criticisms arise. Trivial names for species are very desirable, but their extension to subspecies seems needless. A consecutive list of the butterflies dealt with would have been useful, particularly as the descriptions, following the plates, are not in the correct order: a number in brackets, indicating the order, is given after the Latin name.

Australia has set a very high standard for works of this class and it is to be hoped that other countries will follow suit.

W. H. E.

A REVIEW OF THE NEW MYSORE GAME LAWS by Major E. G. Phythian-Adams, I.A. (Retired), F.Z.S.

On 8th April 1901 a Regulation (No. 2 of 1901) was passed by the Government of Mysore 'to prevent the indiscriminate destruction of Wild Animals and Birds, and to provide for the protection of Game and Fish in Mysore'; and Rules under the Regulation were issued on 11th December 1901. The

Mysore Government have now prescribed fresh Rules which came into force on 1st July 1931. A summary of these is given below.

AREA AFFECTED.

1. The Regulation and Rules extend to the whole of the Mysore State including Jaghir and Inam areas, and thus presumably cover both public and private lands.

DEFINITION OF GAME.

2. 'Big game' includes antelope, ibex, jungle-sheep, sambhur and all other descriptions of deer, bison and tiger; while 'Small game' comprises hares, jungle fowl, peafowl, partridge, sandgrouse, quail, woodcock, bustard, florican, duck and teal. It may be noted that there are no ibex in the State and that Imperial, blue-rock and green pigeons, geese and snipe are not classified as game, though the last two benefit by the close season for migratory birds.

OTHER ANIMALS.

3. The capture and killing of boar, panther and other animals not included in the above definition, and any necessary action for crop protection are not affected by the Rules.

ELEPHANTS.

4. Elephants are dealt with under a separate law.

PROTECTION.

5. The killing of any of the following is prohibited:

(a) Females of bison, sambhur, antelope, ibex or any deer.

(b) Immature males of the above i.e. bison with less than 30 ins. spread, and sambhur and spotted deer with horns of less than 24 ins.

(c) Sambhur or spotted deer stags if hornless or in velvet.

(d) Antelope and peafowl up to 30th June 1935.

(e) Monkeys, brahminy kites and parrots; while the killing or capture of "birds of song or of bright coloured plumage" is also forbidden.

TIGERS.

6. Tigers are now classed as game and as such their pursuit requires a licence, but in Municipal areas and in places where they have become a source of danger to people or cattle, they may be killed without a licence on the recommendation of the Deputy Commissioner.

GAME AND TIGER PRESERVES.

7. Certain State forests have been set aside as game preserves in which no shooting or fishing is permitted without special sanction. Other areas have similarly been allocated as tiger reserves.

CLOSE SEASONS.

8. Close seasons are as follows:—

All small game other than duck and teal 1st March to 1st September.
Duck and teal "and other migratory birds" 1st May to 1st October.
All big game except tigers 15th June to 15th October.

It may be noted that though geese and snipe are not classed as "game", still they may not be shot till after 1st October, and that there is no close season for tiger which is reasonable.

LICENCES.

9. The cost of licences which are obtainable from the D.F.O. concerned, are as under:—

(a) Big game excluding tiger and bison, Rs. 25.
(b) Big game including tiger and bison, Rs. 50.
(c) Small game, Rs. 10.

A big game licence covers the right to shoot small game.

"Professional shikaries" pay double the above fees, but there seems to be considerable doubt as to their definition.

A licence is current from 1st July to 30th June following and is available for one District only and not for the whole State.

A deposit equal in value to the cost of the licence has to be made at the time the licence is taken out.

SALE OF GAME.

10. The sale of any game during the close seasons is prohibited.

LIMIT OF BAG.

11. The aggregate under a single licence shall not exceed 2 of each of the following:—

Tiger
Bison
Sambhur
Spotted deer.
Barking deer.

In the case of a licensee with licences for 2 or more districts, the aggregate shall not exceed 3 of each. Animals once wounded count towards the limit whether brought to bag or not.

SPECIAL CONDITIONS.

12. Sitting up over a waterhole, saltlick or fruit tree for the purpose of shooting game is prohibited.

It should be noted that 'game' includes tiger but does not cover panthers, bears etc.

A return of big game shot has to be submitted at the end of the year under penalty of forfeiting the deposit.

A licence holder is not permitted to shoot in any reserved forest without previously giving notice to the local forest official.

PENAL.

13. Any breach of the conditions of the licence or of the rules renders the offender liable to a fine not exceeding Rs. 100.

FISHING.

14. Certain waters have been set aside as preserved and fishing in these except with rod and line, under a Rs. 5 licence (covering the whole State) is prohibited. The poisoning of any waters with a view to the capture or destruction of fish, or the use of dynamite, fixed engines or small meshed nets is forbidden.

CLOSE SEASONS.

15. The D.F.O. with the approval of the D.C. is authorised to declare by notification in the official gazette any waters as closed against fishing during any year or part of a year, or during the spawning seasons. The latter are declared to be:

Streams running towards the West coast, 1st March to 31st August.
Streams running towards the East coast, 1st June to 31st October.
All other waters including tanks, 1st June to 31st October.

PENAL.

16. Any breach of the conditions of the fishing licence or of the fishing rules will render the offender liable to a fine not exceeding Rs. 100.

REWARDS.

17. Rewards not exceeding the amounts noted below will be granted for shooting wild dogs:

Rs. 50 for a bitch, and Rs. 30 for a dog.

For a tiger killed in Municipal areas or in the cases given in para. 6 above, the reward is Rs. 25 but the skin has to be surrendered to the D.F.O.

REMARKS.

18. The Game Laws as such are sound enough provided that they are enforced, but until the subordinate officials realise more fully their responsibility in the matter of game preservation, no great improvement can be expected. At present poaching is very extensive among the villagers who obviously have no idea that they are committing an offence by offering small game for sale in the close season. Certain Europeans also are great offenders; and the use of cars for shooting at night is common. For such offences a fine is of little use, and confiscation of the car and all the weapons (as we understand is the procedure in East Africa) should be imposed.

Points of interest in the laws are:

(1) Whether the rules can legally be made to apply to private land. At present it would appear that a Jaghirdar or other owner will not be able to shoot on his own land nor permit his guests to do so without a licence. This is certainly carrying the idea of game protection much further than has been done in any part of British India.

(2) The inclusion of tiger as game (with certain modifications) is a sound step which might well be copied by districts outside the State.

(3) The necessity for the protection of blackbuck till 1935 is not very obvious. In spite of much poaching they have increased greatly in many parts and cause much damage to crops. Presumably the villagers can shoot them at any time under the plea of crop protection, so there is no reason why they should not be included in the licence.

(4) The size limit of 24 ins. for stags is certainly on the small side in the case of spotted deer, though probably correct for sambhur, at any rate in most districts.

(5) The demand for a deposit in addition to the licence fee in the case of residents is scarcely justified, and it would have been better either to leave it to the discretion of the D.F.O. or to impose it in the case of non-residents only. Residents should also receive the benefit of reduced fees especially as such large areas have ben set aside as Game Preserves which the ordinary licence holder is not permitted to enter.

(6) The omission of a minimum bore of shooting bison (·333 H.V. with a bullet of not less than 300 grs. is suggested), and of a rule prohibiting the use of cars or artificial light for the pursuit of game, is to be regretted; the latter is most necessary.

(7) The clause protecting 'birds of song and bright plumage' is too vague to be effective. It would be of more use to declare all birds protected except such species (to be named) as are injurious to fruit or crops.

GAME ASSOCIATIONS.

19. The formation of Game Associations in the various districts would do much to assist in the enforcement of the Game Laws with adequate help from Government. Such an Association was formed in the Mysore district in 1929, but up to date its functions have been purely advisory, it has no funds with which to maintain a staff of game watchers and to reward informers in cases of poaching. If Government would sanction the fees for licences being handed over to the Association, as is done in the Nilgiris, much might be effected.

E. G. P.-A.

MISCELLANEOUS NOTES.

I.—PANTHERS FEEDING ON TIGER 'KILLS'.

I had known of panther turning up and feeding off tiger kills, and had often wondered what would actually occur if the tiger happened to come along and catch the panther unawares.

On the 23rd of this month I had the opportunity of satisfying myself in this respect. News of a tiger kill was brought in to me late in the afternoon, the result being that I had to get the machan up in a hurry and was in fact not seated on the machan till after dark. A good deal of the kill had been eaten, not from the buttocks, where a tiger generally commences to feed or from the stomach where a panther usually starts, but from the neck. I had had no time to look for tracks, and so when a panther turned up shortly after my men had gone I came to the conclusion that the kill was the work of two panthers. On this assumption I shot the panther expecting its mate to turn up as had occurred on two previous occasions, when a pair had been bagged over a kill the same night. About an hour later, I heard what I at first took to be the approach of a big panther, and then realised it to be a tiger. The tiger made the usual detour and finally approached the kill on the side the panther was lying. Stopping short on seeing what he thought was the panther feeding on his kill, he paused for a moment, and then with a terrific leap he was on the panther, and before I could switch on my torch the latter had been dragged into high grass.

The end of this tale is a sad one. In an opening in the grass a few moments later I fired at what I thought to be the tiger's chest, but really another portion of its anatomy, and although I followed the tiger up the whole of the following day and, when all blood tracks ceased, searched all likely areas for the next three days, I lost my tiger to my deep regret. It is easy to be wise after the event, but of course I should have allowed the tiger to demolish the panther and return to its kill later in the night or the following night.

Strangely this happened to be the third occasion in one month in which a panther turned up at a tiger's kill, affording in one of the instances an opportunity for daylight photography, which Mrs. Herman Cron (a first rate sportswoman, big game photographer, and authoress of the charming book, *The Roaring Veldt*) took full advantage of as the panther came early.

It may not be out of place to mention here that Mrs. Cron possesses unique photographs, taken by her in daylight from a hide, of tigers feeding on their baits.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE.
March 20, 1933.

R. C. MORRIS,
F.Z.S.

II.—TWO EXPERIENCES WITH PANTHER.

The following two stories which are authentic will show how much a bold panther will stand.

Two panthers, one big and one small, were harassing a village in the West Khandesh District. When I arrived there, I found many of the village cattle bitten severely in the throat and one cow in a dying condition. As there was no '*gara*' it was rather difficult to decide how to proceed; however, I selected a tree more or less on the panther's usual line of approach and tied up a bleating goat. Before I got up, a villager came running along to say that a large panther had just killed a calf about 3 miles away in the jungle. I jog-trotted to the place and found that the panther had moved on, dragging the calf with him. The tracks were perfectly clear and we traced him quite easily to a small nullah, overlaid with bushes. As it was impossible to get in a clear shot I decided to drive him off the kill and drag it to a more convenient place. My *Bhil* orderly and I therefore stoned him out of the nullah. He was very reluctant to go, and made a deuce of a song about it but eventually he went, and my orderly climbed down into the nullah and pulled up the calf while I covered him with my rifle. I selected a convenient tree about 20 yards away and got up hurriedly. Within 10 minutes I heard the panther come snarling along, and within a quarter of an hour he was on the kill. I switched on my light and he immediately bolted and I sent an ineffectual shot after his tail. Cursing myself for my rotten shooting, I climbed down and went back to the village, when I found I had left my wrist watch in the machan. I left instructions for it to be looked for the next morning and went home. My Sub-Inspector of Police arrived the following morning with my watch which was smashed, and told me that the panther had again come back, had climbed the tree and had ripped everything to pieces.

The second story is certainly not one to be proud of, but is worth mentioning.

A panther killed a dog and dragged it half way up the side of a precipice. When I got there I found that there was only one tree, entirely bare of branches, and most unsuitable for a machan. I therefore decided to sit on the ground and my orderlies covered me with branches. About 6 p.m. I saw the panther coming along the top of the precipice behind me. He came down the hill passing me within touching distance and went straight on to the 'kill'. His method of approach and subsequent behaviour were strangely at variance. He took fully half an hour to move 200 yards and sat down about half a dozen times. He gave me a beautiful broadside-on shot which I gracefully missed whereupon he jumped about 5 yards in the air, and sat down to think about it, giving me another opportunity which I again failed to take, after which he bolted. I was about to blow my whistle to summon my men when I saw a yellow paw coming out from behind a bush, and to my astonishment I saw the panther again coming on to the kill. This time I made no mistake and sent him to the bottom of the precipice with a bullet through his heart. This was an enclosed place and a 500 express rifle made the very devil of a noise, yet, though on his approach he had suspicion written on every line of him, two ear-splitting explosions failed to turn him off the kill.

DHULIA. L. F. RUSBY, D.S.P.,
January 21, 1933. *Captain.*

III.—WILD DOGS KILLING A PANTHER.

Yesterday I came across an interesting case of a panther having been killed by wild dogs. Apparently what occurred was this:—A pack of wild dogs were lying up in some thick cover, and one of their number went down to water, and was immediately pounced upon by a panther. The noise it made when it was seized brought the whole pack down. In the furious fight that followed the panther was torn to pieces. I discovered no traces of other dogs having been killed in the fight.

HONNAMETTI ESTATE,
ATTIKAN P.O., R. C. MORRIS,
Via MYSORE, S. INDIA. F.Z.S.
February 15, 1933.

IV.—WILD DOGS DRIVING A PANTHER FROM ITS 'KILL'.

I have received a most interesting account of wild dogs turning up at a panther's kill at night and driving the panther off from Col. J. Pottinger of Kotagiri. I give below Col. Pottinger's account of the incident:—

'The panther first made me aware of his presence about 6 p.m. by the gentle crushing of a leaf a little way behind me. Nothing more happened till 7 p.m.; when an old porcupine—very hot and bothered—came down the fire-line and "winding" the panther pushed off in the other direction "at the rate of knots"! Nothing more occurred till 9 p.m., when from the fire-line behind me, I heard a peculiar noise of which I was unable to diagnose the maker. I was certain it was not the panther, but some other animal which had winded it—until (after making a small detour) the maker of the noise turned up from another fire-line and stood by the kill in the brilliant moonlight, intently looking down the fire-line behind me towards where I felt certain the panther was in hiding: it was a single red dog! The latter was thoroughly on the alert, but showed no sign whatever of fear. Keeping an eye all the time in the panther's direction he took a few hasty mouthfuls; then whipped round and cantered off to call his pals.

Within a couple of minutes I heard their peculiar gentle whistling call, which was repeated from the other side of me, and the next moment a strong pack of between 10 and 15 had appeared on the scene with the ghostly silence of a transformation scene at a pantomime! Almost immediately three or four of them detached themselves from the rest of the pack and started patrolling along the edge of the jungle, making a noise as though several dogs were having a real good "scrap" though I could clearly see in the brilliant moonlight that they were not scrapping at all with one another. Twice this patrol went along the edge of the jungle making this fighting demonstration—obviously intended to intimidate the panther, who, I had all along felt sure, was concealed near the edge of the fire-line close to where they were patrolling—watching.

The patrol had hardly joined their friends round the kill for the second time—none had so far started to feed—when all of a sudden they all looked away from the kill down the fire-line, which passed behind me on my right. The next moment, like an arrow from a bow, the whole lot dashed past me up the fire-line, and pandemonium was let loose! Every red dog was making the fighting noise, referred to, at the top of its voice, while the panther, which obviously had the "breeze vertical" shouted his disapproval and alarm with the subterranean grunts and snarls which they make when scrapping with one another! It was really a thrilling moment and I decided that as they were all so busy with their own affairs I could turn round and see the scrap (which was going on behind me) as well as hear it, and that I possibly might get a shot at the panther at bay before he bolted.

Unfortunately, however, before I had time to kneel up and fully turn round, the panther had been driven off and the pack were returning to the kill! So I once more turned round and sat down, deciding to "out" as many red dogs as I could since there was little chance of the panther coming back. I must say that I would much rather have seen and heard all that occurred even though it meant not bagging the panther, than to have got the panther without any unusual incident. I had, of course, often heard of red dogs driving both panther and tiger off their kills, but had never witnessed such a proceeding.'

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE, S. INDIA.
February 8, 1933.

R. C. MORRIS,
F.Z.S.

[Wild Dogs will attack both leopards and tiger not as quarry but as the result of a quarrel over a kill or from their inborn love of baiting an animal.

In an early issue of the *Journal* (Vol. v, p. 191), Mr. A. Wright gives an account of two panthers 'treed' by Wild Dogs. He and a friend tried to bag the panthers, whereupon one of them leapt down and was immediately pursued by the pack, the other was shot, but stuck in the fork of a tree. Some of the pack came back and were seen standing on their hind legs to lick up the blood as it streamed from the dead beast, out of their reach in the tree.

In Vol. xviii, p. 194 of the *Journal*, Lt.-Col. Jones recorded a similar case of wild dogs chasing a panther which took refuge in a tree. A curious incident, related by Mr. D. Bourke of the Forest Service (Vol. xxiii, p. 343), is that of a panther being kept away from its kill by two village pie dogs! The dogs resented being disturbed at their meal and stood their ground barking furiously. They did not give away an inch and kept the panther away for an hour till called off by Mr. Bourke's shikari.—EDS.].

V.—A NEWLY BORN BISON CALF.

An interesting event took place while a party of us (Col. and Mrs. Newcomb, Mr. and Mrs. Salim A. Ali, Mrs. Morris and myself) were watching a herd of bison.

One of the cows calved. Ten minutes after birth the calf was walking about, and 20 minutes later when the herd took alarm and went off the calf galloped after its mother.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE, S. INDIA.
January 5, 1933.

R. C. MORRIS,
F.Z.S.

[In an early issue of the *Journal* there is a reference by Mr. J. D. Inverarity to a new born bison calf which he came across. It lay crouched in the long grass with its neck stretched along the ground—a position in which it was not readily noticeable—its light yellow colouring blending with the dry grass. The mother on being disturbed left it and joined the herd which Inverarity was tracking. The herd made a circuit of a mile or two and eventually came back to the place where the calf had been left.—EDS.].

VI.—GAME RESERVES AND FLASHLIGHT.

Mr. F. W. Champion has in accusing me of being hasty in my letters to the press committed this very error, and it would rather seem as if he had been touched on the raw by my note together with other articles that have appeared on the subject in the *Field*.

It is obvious that Mr. F. W. Champion has taken my note as a hit against *all* Flashlight Photography. It is nothing of the kind. I consider Mr. Champion's book *With a Camera in Tiger Land* a classic of its kind, and the reader does not have to be a photographer to realise the infinite pains and trouble involved in the taking of those very excellent photographs for which nothing but praise is due. My note however is a criticism of the 'mass production' photographer. I have seen the work of one of them, and I again assert that nothing in my opinion is more disturbing to game. This opinion is shared by men of Mr. Champion's Service and others of the Civil Service to whom the matter was referred by the Madras Government. A flashlight camera in the hands of Mr. Champion, and others who do the work in a similar sportsman like manner, renders a service by the studies of nature produced, but in the hands of a man who is out for monetary gain or other reasons it is a nuisance and a disturbing factor in the jungle.

I will quote the instance of a man whom I was with. With the exception of one or two cameras placed over kills the others were invariably over water holes and salt licks, and on account of the work involved in setting the collection of cameras he started in at about 10 a.m. Half or more of the exposures would be taken by birds touching the wires, and these as often as not were reset in the afternoon. The flashlight powder was so arranged that the explosion went off with a loudish report, and these reports could be heard all over the jungle day and night. The photographer admitted to me that he would not think of erecting cameras at pools over which I have observation machans, for one of my hobbies in the dry weather is to spend moonlight nights on these machans observing game. I do not know what has made Mr. Champion think that I am ('and others like me'!) a slaughterer. With a few exceptions I have for years now confined my hunting to the destruction of rogue elephants and occasionally cattle killing tiger and panther. I have always been ready however to help sportsmen who are less favourably situated than I am for one of the finest sports in the world, big game hunting.

Mr. Champion may be interested to hear that I am keen on animal photography myself, daylight photography and on foot, which requires as much skill and other attributes as is involved in the taking of Flashlight Photography, and I work for the Preservation of Game in South India. Without wishing to decry the fine sport that Wild Life photography is, it cannot be gainsaid that the risks incurred in this form of sport are not equal to the issues involved in the hunting of what might be called the 'dangerous' Indian big game with the rifle, with the exception perhaps of elephant and bear.

Mr. Champion in his enthusiasm for his hobby errs in taking up a bigotted attitude against big game hunting. A man can be a shikari and still be a thorough sportsman and a lover of wild animals, a fact which Mr. Champion is possibly unable to appreciate. Further, if every one laid aside their guns and rifles, Science would be the poorer. I venture to say that just as much Natural Scientific knowledge has been accumulated from the examination of relics of the dead as from a study of live animals in their natural state. Admittedly, big game hunting can be overdone, but so can animal photography, whether flashlight or daylight; my note was never meant to be a criticism of an 'occasional flashlight', and Mr. Champion should have realised this, and not rushed into print with a note which, in part, has not been written in the best of taste.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE, S. INDIA.
November 29, 1932.

R. C. MORRIS,
F.Z.S.

VII.—OCCURRENCE OF THE SIND BABBLER (*CHRYSOMMA ALTIROSTRIS SCINDICUS*, HARINGTON) IN THE DERA GHAZI KHAN DISTRICT OF THE PUNJAB.

This race of *Chrysomma* has hitherto been known only by the type specimen in the British Museum, which was collected by Blanford near Sukkur and described by Harington in this *Journal* (vol. xxiii, p. 424) in 1918. It is, therefore, of interest to record that I came across a small party of some half a dozen of these birds on the Indus, near Jampur in the Dera Ghazi Khan District on November 29, 1932. The locality was exceedingly dense grass jungle, four to six feet high, on the bank of the main stream. They did not appear at all shy or inclined to skulk, and I had no difficulty in collecting two of them. These have been compared with the type by Mr. H. Whistler, who writes that they are 'rather greyer, but that may be because the type is not a mature bird—there could hardly be two races in the riverain of the Indus'. I only met with the bird on this one occasion in the course of three weeks camping up and down the river between Ghazi Ghat and Kot Chutta.

DANDOTE,
JHELUM DISTRICT,
PUNJAB.
February 8, 1933.

H. W. WAITE,
F.Z.S., M.B.O.U.,
Indian Police.

VIII.—THE BLACK BACKED SHRIKE (*LANIUS NASUTUS NIGRICEPS* [FRANKLIN]).

In the *Mission Babault dans les Provinces Centrales de l'Inde, Region Himalayenne et Ceylan* 1914, *Resultats Scientifique* (Paris, 1920), pp. 156-157, mention is made and a plate is given of a shrike obtained by M. Babault at Chitailongri, C.P., on March 30, which he describes as a hybrid between *nigriceps* and *erythronotus*. Owing to the kindness of M. Berlioz of the Paris Museum I have been enabled to examine this specimen as well as the three others obtained by M. Babault at Sijhora (February 9), Subkar (March 18), and Garhit (March 20). All these four birds belong to one form which is the grey backed Black-headed Shrike the true *Lanius nasutus nigriceps* (Franklin). It is easy to see why M. Babault considered the one bird a hybrid, for he was comparing it with the rufous backed birds of Sikkim and Assam, hitherto erroneously called by Franklin's name. But it is not easy to see how he considered it different to the other three. Except for a slightly larger white speculum and wear and bleaching of the mantle and a doubtful retention of some outer juvenile tail feathers, it agrees with them closely.

CALDBEC HOUSE,
BATTLE, SUSSEX.
November 13, 1932.

H. WHISTLER,
M.B.O.U.

[The above note is intended as an amplification of Mr. Whistler's observations on this shrike, published in the last issue of the *Journal* (Vernay Scientific Survey of the Eastern Ghats, Part IV, *J.B.N.H.S.*, xxxvi, p. 334)—EDS.].

IX.—NOTE ON THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS (ORNITHOLOGICAL SECTION) WITH REFERENCE TO THE RACES OF *OTOCOMPSA JOCOSA*, *CHLOROPSIS AURIFRONS*, ETC.

On page 757 of vol. xxxv of the *Journal*, Mr. Whistler records the fact that the range of the races of *O. jocosa* is very imperfectly known. So far, all birds from the Central Provinces have been put down as *fuscicaudata* by McMaster, Moss-King, Osmaston, myself and others. The Red-Whiskered Bulbul is not universally distributed in these Provinces but is confined to elevated forested areas only. It is common in the Melghat (Chikalda) and at Pachmarhi and I have also seen it near Lougher, 1933 in the Balaghat district and in the Chhindwara district. Recently, for the first time, after a long residence, I secured one of a pair at Nagpur which turned out to be *emeria* and not *fuscicaudata*. These I take to be stragglers from the East. I sent this specimen to Mr. Whistler and he agrees with my identification but it was too late to make mention of it in his paper. We have mounted specimens from Chikalda which appear to be *fuscicaudata* and most probably the Pachmarhi birds are also of this race as well, for birds from the Western Ghats have a tendency to invade the Central Provinces from this direction. Birds from Balaghat and Chindwara will have to be examined. I shot some at Laugher, while moving camp, but, as we were unable to make a halt the next day, the birds could not be skinned and we never came across them again.

Chloropsis aurifrons davidsoni.—The range of this bird also extends into the Central Provinces. I found it common on the banks of the Indravati River in the Ahiri Zamindary adjoining the Bastar State. Wing measurements ranged from 100-102 mm. in the males. McMaster's statement in the *Old Fauna* that it is found at Chikalda is sure to be verified.

Saxicola caprata burmanica.—I took a slightly advanced clutch of four eggs on the 22nd May near Yercaud on the Shevaroy Hills at an altitude of 5,000 ft.

CENTRAL MUSEUM,
NAGPUR.
December 22, 1932.

E. A. D'ABREU,
F.Z.S.

X.—OCCURRENCE OF THE BLUE-THROATED BARBET (*CYANOPS ASIATICA*) AT MURREE.

I shall be glad if you can let me know whether the Blue-throated Barbet (*Cyanops asiatica*) is considered to be a common bird in Murree. I gather from the bird books in my possession that it is usually found at lower altitudes than this (over 7,000 ft.) and it is also rather indicated that it is not as a rule found west of Chamba. Yesterday, however, walking along the Mall in the snow, I saw a Blue-throated Barbet sitting on a tree close by eating berries. As I had my glasses with me I had a good look at him and there could be no mistake about what he was, and also when I returned that way a couple of hours later he was still in the same tree. I shall be much obliged if you can give me some information on this point.

THE PARSONAGE,
MURREE.
January 3, 1933.

E. A. STORRS FOX,
Chaplain.

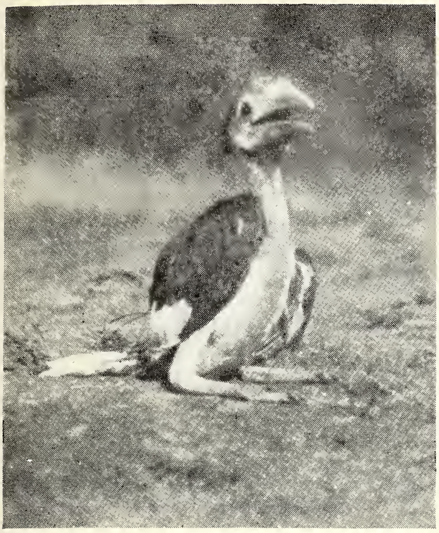
[The Blue-throated Barbet ranges from Murree to Kashmir through Nepal, Sikkim and Assam and practically through the whole of Burma. It is however rare anywhere east of Nepal. It was not recorded by H. A. F. Magrath, *J.B.N.H.S.*, xix, 142, in his list of the birds of Murree and the Gallies.—EDS.].

XI.—NOTE ON THE DEVELOPMENT OF THE CASQUE OF THE INDO-BURMESE PIED HORNBILL (*ANTHRACOCEROS ALBIROSTRIS*).

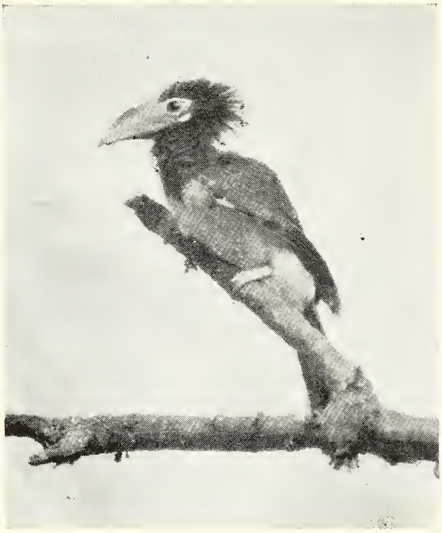
(*With a plate*).

Possibly some doubt may exist as to how long it takes for the casque to develop on the beak of this hornbill, in which case the following account of a tame bird in my possession may be of interest.

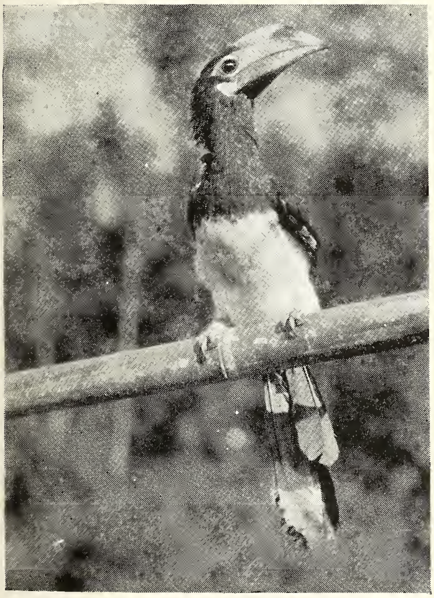
On July 4, 1929, the Mikirs brought to me a very young bird, which could not even stand up and was only partly fledged (see photo No. 1). Its home was more than twenty miles away, so I could not return it, but fortunately I was entirely successful in the difficult task of rearing it. It became extraordinarily tame, and stayed with me till December of the same year, when it apparently flew away with some older ones which continually came to roost in a bamboo barri close to my bungalow.



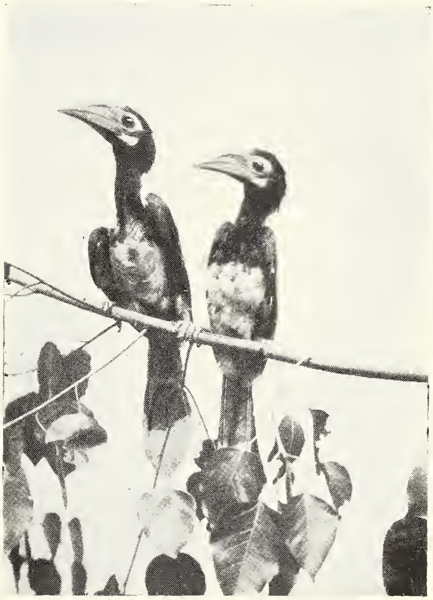
1. Young bird partly fledged. July 4th 1929.



2. Same bird fully fledged. End of August 1929.



3. Same bird December 1929. 5 months after capture. The casque is just forming.



4. Hornbills reared by the author in 1932. Fully fledged without the suspicion of a casque.

Indo-Burmese Pied Hornbill.

(Illustrating development of casque).

Photograph No. 2 shows the same hornbill just after it had become fully fledged, and was taken about the end of August, after I had kept it nearly two months. There is very little suspicion of a casque forming yet. Photo No. 3 was taken not long before the bird flew away, at the beginning of December as far as I can remember. It might have been taken at the very end of November, but in any case, it was taken about 5 months after the bird was brought to me. In this photo there are unmistakable signs of a casque forming, so I conclude that it must take about 7 to 9 months for the casque to mature.

Photo No. 4 is of hornbills I reared in 1932, taken on August 19, and the evidence from it coincides with that from photo No. 2 of the 1929 bird, namely that when these birds are fully fledged there is practically no suspicion of a casque.

BAUDLIPAR TEA CO.,
HANTLEY P.O., ASSAM. E. P. GEE.
November 16, 1932.

XII.—OCCURRENCE OF THE WOODCOCK (*SCOLOPAX R. RUSTICOLA*) AT JHINJHANA, U.P.

In case it should interest your Society, I have to report that I shot a Woodcock on 27th instant near Jhinjhana, some 30 miles due west of Muzaffarnagar in the United Provinces. As this district is definitely a plains one and not sub-montane, the occurrence may be worthy of record.

A very heavy thunderstorm with rain on night 23rd-24th instant presumably drove the bird down whilst on migration.

I may say I have seen Curlew (not Whimbrel) on six occasions this month in this district. I do not know how common this species is in India but I have only seen it once previously in nine and a half years out here.

THE BLACK WATCH, W. N. ROPER-CALDBECK.
MEERUT, U.P.
December 31, 1932.

[In India, the Woodcock is merely a casual migrant to the plains the great majority of Himalayan birds being resident or moving to lower levels in winter. The Curlew which visit India in the cold weather belong to two races. The Common Curlew (*Numenius arquata arquata*) is fairly common during the cold weather in the north-west and straggles down southwards to Ceylon. Baker gives the eastern limits of its distribution as Delhi and states that nearly all the birds from eastern India are referable to the second race, i.e. the Eastern Curlew (*N. a. lineatus*) which differs from the western form in having much finer and paler streaks on the lower plumage; the axillaries are pure white with pale streaks on the longest feathers (they are boldly streaked with black in the western race).—EDS.].

XIII.—OCCURRENCE OF THE EUROPEAN BUSTARD (*OTIS TARDA TARDA*) IN THE NORTH-WEST FRONTIER PROVINCE.

It may interest you to learn that a villager brought in to me yesterday a female *Otis tarda tarda* which he had shot the day before. Its measurements were:—wing 20 inches; spread from tip to tip 67 inches; length 33 inches. It weighed 6½ pounds, having been cleaned before I got it. Its colouring was exactly as described in Stuart Baker's book, the chestnut band of the male being visible only as patches at the side of the lower throat.

Curiously enough, it was I who obtained the specimen recorded on page 145 of Stuart Baker's Game Birds, volume ii, as having been sent to you by Sir George Roos Keppel on whose staff I was then serving. The weather at that time, I remember, had been unusually cold and it is interesting to note that on Friday last (December 23rd) there was a fairly heavy fall of snow over all the higher hills to the north.

The plumage of the specimen now brought in has been somewhat damaged and it is not worth sending the skin to you.

Another female *Otis tarda tarda* was shot some miles south-east of Mardan (Peshawar District) on 8th January. Its measurements and weight were as follows:—length 32 inches; spread 66 inches; wing 19 inches; weight 8½ pounds.

GOVERNMENT HOUSE,
PESHAWAR, N.-W.F.P.
December 30, 1932.

G. CUNNINGHAM,
I.C.S., C.S.I., C.I.E., O.B.E.

XIV.—ON THE OCCURRENCE OF THE SHORT-EARED OWL (*ASIO FLAMMEUS FLAMMEUS*) IN MADRAS CITY.

The first edition of the *F.B.I.*, vol. iii, p. 272, says that the bird is 'less common to the southward during its migratory winter flight'. In the second edition this statement is modified to 'it has been found within our limits as far south as the Malay Peninsula and is some years a comparatively common visitor to Ceylon'. (Vol. iv, p. 394ff.).

Being a migratory bird that wanders southwards from Asia and Central Europe, it will be very interesting to record its winter habitat.

It has been occasionally recorded in Madras, but during the past ten years, I noticed this bird in the city, only one cold weather, and that was towards the end of November 1923. I have never seen these birds again in Madras.

These birds seemed to have arrived in large numbers that year and a few of them took up their residence in the large stretches of seashore grass, *Spinifex squarrosus*, that was abundant in those days on the foreshore, opposite Fort St. George. The birds stayed on in this place till the end of January, when they disappeared totally. One reason for their not being noticed in that locality now, may be due to the foreshore being converted into playgrounds and the disappearance of all the *Lantana* bushes and stretches of *Spinifex* grass.

The pellets found in these grass patches were examined and found to contain the skulls and bones of not only some species of field mice but also of bats. One curious thing that I noticed, during the stay of these birds on Madras beach, was that the birds invariably roosted in the female patches of *Spinifex*, I flushed many birds from these grass-patches and found their pellets in large quantities, but not one stray pellet was found in the stretches of male *Spinifex* close by.

These birds did not seem to be disturbed in the least by the numerous people on the seashore, but sat here and there, lazily flapping now and then, from place to place like the Brahminy kites that were in large numbers on the sea edge. They of course became more active as the night deepened.

MADRAS CHRISTIAN COLLEGE, A. S. THYAGARAJU,
MADRAS. M.A.
November 30, 1932.

XV.—OCCURRENCE OF THE GREAT CRESTED GREBE (*PODICEPS CRISTATUS CRISTATUS*) IN BIKANER.

I am sending under a separate parcel, the skin of, I think, a Great Crested Grebe, which was shot by the Heir-Apparent on the Gajner Lake, Bikaner, on the 20th February, 1933. This is the first bird of its kind ever shot in Bikaner and the Prince will be grateful by your kindly letting me know:—

(*a*) Whether it is the 'Great Crested Grebe'?
(*b*) Whether its occurrence in this part of the country is unknown so far or otherwise?

BIKANER, SURAJMAL SINGH,
March 20, 1933. *Secretary,*
Heir-Apparent of Bikaner.

[The bird forwarded by the Secretary to the Heir-Apparent proved to be a Great Crested Grebe (*P. c. cristatus*). There appears to be no previous record of the occurrence of this bird in Bikaner. In India it breeds in Kashmir and it has been recorded from Oudh, Behar, Bengal and Assam during the cold weather.—EDS.].

XVI.—MASKED BOOBIES (*SULA DACTYLATRA*) AT SEA 350 MILES FROM BOMBAY.

The first morning out from Bombay there was a flock of Masked Boobies—*Sula dactylatra*—which kept up with the ship from about 10 a.m. till lunch time. There were 8 in all, two of them immature birds. We were 350 miles from Bombay at mid-day. It was impossible to identify the sub-species. Apparently there are not many records of the species from Indian seas, so the occurrence may be of interest.

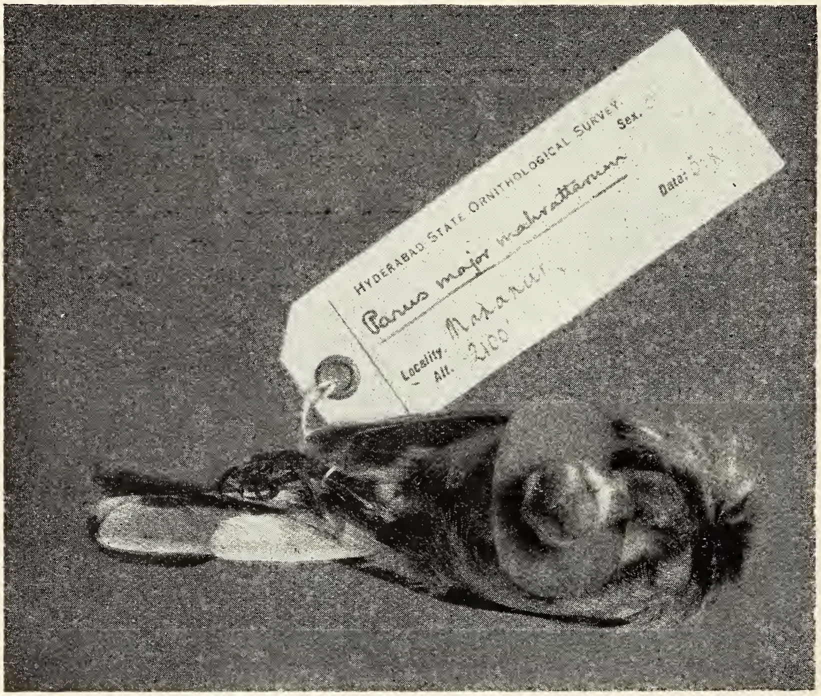
COLOMBO. W. E. WAIT,
December 14, 1932.

[A note on the occurrence of the Masked Booby in Bombay Harbour appeared in vol. xxi, p. 1334. These birds are occasionally blown inshore by the monsoon gales. There are three in the Society's collection taken in Bombay Harbour during July and August, and a fourth which was caught in the Railway Workshops at Parel in August, 1927.—Eds.].

XVII.—A CASE OF *OSTEOGENESIS IMPERFECTA* OCCURRING IN A WILD BIRD.

(*With a block and 2 text-figures*).

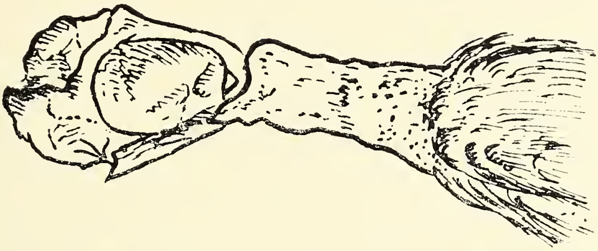
Amongst the ornithological material received by Mr. Hugh Whistler, who is at work on the birds collected during the recent Hyderabad State Ornithological Survey, is an immature male example of *Parus major maharattarum* collected by Mr. Salim A. Ali on October 5, 1931 at Mananur.

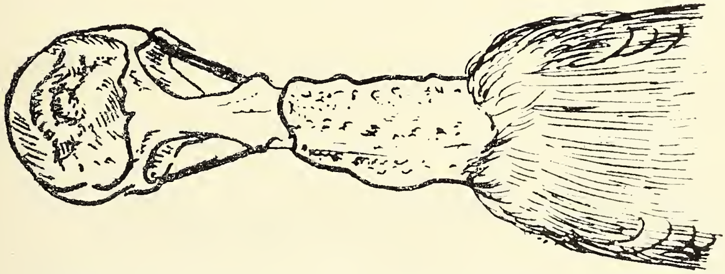


Scale of photograph approx. 1/1.
Photograph by E. Fielder, Sevenoaks.

Mr. Ali recognizing the fact that there was a gross abnormality of the cranial vault made the skin up with the skull still exposed as is shown in the accompanying plate. There was apparently nothing in the bird's behaviour to lead one to suppose that it was in any way affected, and the condition was only discovered on skinning the specimen.

The figure shows very plainly the deficient ossification affecting the whole of the cranial vault, the lesion which is remarkably symmetrical measures 11 mm. in the antero-posterior diameter, and 12·5 mm. in the transverse diameter. It is bounded anteriorly by the frontal bones, laterally by the temporal portions of the parietals, and posteriorly by the occipital. All these bones possess normally ossified hard outer tables, contrasting markedly with the thin, in places almost membranous irregularly and poorly ossified, vault. The edge of the normally ossified bone is not unduly heaped up, suggesting very strongly that the lesion represents therefore a deficiency in normal development and not an inflammatory process. The abnormal area is roughly divided transversely by a more or less bony ridge, giving rise to a sulcus immediately behind the frontal region and a somewhat similar one in front of the occipital bone. This ridge probably represents an attempt on the part of the ossific centres to effect calcification in the vault. The cranial capacity is apparently normal.





The condition would appear to be analogous to *osteogenesis imperfecta*, in which it is principally the bones of the cranial vault which are affected, and in which normal ossification has failed to occur.

I am indebted to Mr. Whistler for referring this interesting and unusual specimen to me.

KENT, JAMES M. HARRISON,
ENGLAND. D.SC., F.Z.S., M.B.O.U.
March 23, 1933.

XVIII.—MONSTROSITIES IN TROUT FRY (*SALMO FARIO*) IN KULU.

(*With four text-figures*).

Alterations in the normal condition of light and darkness, and changes in the temperature produce remarkable effects on animal development. The hatching period, for instance, in fishes varies with the temperature of the water, and it can be prolonged or shortened by lowering or raising the temperature. In Trout (*Salmo fario*), for example, the hatching in 37°F takes 165 days, while in 52°F temperature of water, it takes only 38 days. The eggs can be successfully transported over long distances by packing them in ice and thus retarding their development and prolonging the hatching period. *Ophicephalus marulius* takes 54 hours to hatch out in 61°F to 79°F, and 30 hours in 83°F to 92°F temperature of water; and *Labeo gonius*, *Cirrhina mrigala*, *Wallago attu* and other local carps and cat fishes take less than twentyfour hours to hatch out in temperature ranging from 76°F to 98°F.[1] 'So dependent on the temperature is the rate of development that if one side of an egg be only heated then development on that side will be more rapid than on the other and the embryo will become bilaterally asymmetrical.'[2] Monstrous forms can be produced in a culture of *Paramoecium caudatum* by reducing the temperature to 30°C and then allowing it to rise again to the normal temperature of the room. Ultra violet radiation produces similar results.[3] 'Experiments on the developing hen's egg showed that if the ultra violet rays were directed against the shell no results were obtained, but if a window was made in the shell, so that the rays could pass through, then a number of changes took place, among which were the production of double monsters or the duplication of parts.

Five thousand ova of *Salmo fario*, kept in light, saved from the direct rays of the sun, but exposed to all external influences, and five thousand kept in dark sheds, inside covered troughs, exhibited, on hatching, the following characteristic differences:—

Fry hatched out in light.	Fry hatched out in dark.
1. Light in colour.	1. Dark in colour.
2. Weaker but active.	2. Robust but not active.
3. Death rate 3 per cent in the troughs, in the Hatcheries.	3. Death rate 2 per cent in the troughs, in the Hatcheries.
4. Death rate in transit ½ per cent. They stood the journey better, moved swiftly when released into the stream, and tried to swim against the current.	4. Death rate in transit 1.2 per cent. They seemed to be exhausted when taken out of the fish carriers and sank down to the bottom.
5. Yolk sac absorbed earlier.	5. Yolk sac absorbed later.
6. Abnormalities noticed.	6. No abnormalities.

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[1] Sewell, R. B. S. Presidential Address, 18th Ind. Sc. Cong. 1931.

[2] 'de Garis, C.F. Journ. Exp. Zool. vol. xlix, p. 133, 1927' as quoted by R. B. S. Sewell, Pres. Add. 18th Ind. Sc Cong. 1931.

[3] 'Hinrich, M. A., Journ. Exp. Zool. vol. xlvii, p. 309, 1927' as quoted by R. B. S. Sewell, Pres. Add. 18th Ind. Sc. Cong. 1931.

ABNORMATIONS NOTICED IN THE FRY WERE:

1. Fry with double head and body, with one yolk sac, undivided tail and single caudal fin (fig. 1). They died before they commenced feeding. They measure 12 mm. in length each.

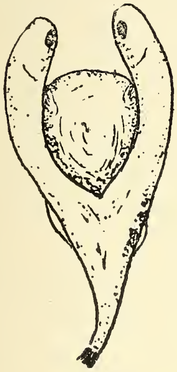

Fig. 1.

2. Fry in which yolk sac has been almost absorbed, body and tail are normal, but there are three distinct eyes. It measures 18 mm. in length, and has got well developed dorsal, pectoral, ventral, anal and caudal fins. Mouth open. Head broad, possessing two lateral and one median eye (fig. 2).

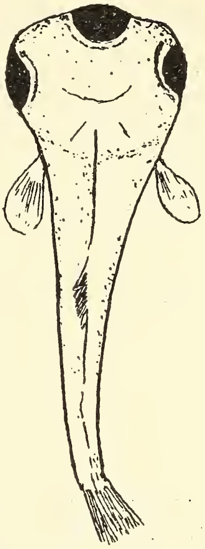

Fig. 2.

3. Twin fry, in which the yolk sac has been absorbed. Two normally developed heads, open mouths, double pair of pectoral fins, two dorsal fins. Ventral parts, behind the operculum, united up to the posterior end of the caudal peduncle. One pair of ventral fins and single anal fin. The tail is one, but it possesses two caudal fins. Length 17 mm. (fig. 3).

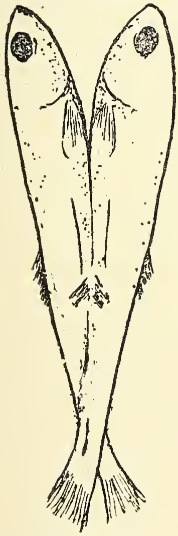

Fig. 3.

4. Fry showing asymmetrical body, coiled like a snail's shell. Pectoral, dorsal, ventral, anal and caudal fins well developed. Yolk partially absorbed. Yolk sac still a prominent structure upon which the body lies coiled, either on the left or the right side. The fry when coiled measures 8 mm., but when its body is opened the length is 17 mm. (fig. 4).

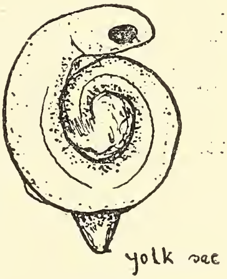

Fig. 4.

Production of monstrous forms in Trout fry is evidently due to the effect of light on developing eggs. Fry hatched out in light though apparently weaker, possess more vitality, and fare far better during transit, than those hatched out in the dark.[1] Darkness often breeds fungus, parasites and produces other afflictions injurious to young fish.

M. HAMID KHAN, M.SC., LL.B.,
Fisheries Research Officer.

LAHORE,
PUNJAB.
January 18, 1933.

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[1] Hooper, G. L. 1916, *Fishing Gazette*, 15th April, 1916.

XIX.—OCCURRENCE OF THE RUSSELL'S VIPER (*VIPERA RUSSELLII*) IN LOWER SIND.

With reference to the concluding sentence of the note on page 272 of the current issue of the Journal, regarding the occurrence of the Russell's Viper in Lower Sind, it may be of interest to know that on four successive nights in March 1923, I killed full grown specimens of this snake under my bed at Jherruck, Karachi district. The alarm in each case was given by my dog. I watched the first one to see what it would do. It made straight for the hurricane lamp and coiled itself up in the angle of the mud wall near which it was standing, where it was practically invisible.

I conclude there must have been a nest nearby.

BELGAUM.
December 2, 1932.

J. W. ROWLAND,
Supt. of Police.

XX. THE SAW SCALED VIPER (*ECHIS CARINATA*) ABOUT IN WINTER.

This afternoon at 3 o'clock, during the course of a walk over the stony, arid plain that lies beteen Islamia College and the mouth of the Khyber Pass at Jamrud, I killed a snake which I identified by Col. Wall's 'Poisonous Terrestial Snakes of India' as a Phoorsa, (*Echis carinata*). The remarkable thing was that a few yards away was a sheltered pool of seepage water from a tiny irrigation channel which was completely frozen over, though it was the warmest time of the day. There have been heavy frosts here lately and a snake was about the last thing I expected to see. I have always understood that in this part of the world they hibernated until late in February. During seven years residence I have never seen one at this time of the year. The snake was apparently sunning itself on a small sandy mound, near a hole from which it had possibly crawled. It appeared to be asleep. Having no stick, and there being no trees or shrubs near by from which one could be obtained I lobbed a heavy stone, of about 8 lbs. weight, upon it. It hit it fairly on the coils and rolled off. As it made no movement whatever, I concluded it was done for and went forward to examine it. It suddenly drew back on itself and struck at me as quickly as lightning. I did not notice whether it hissed or not, as any sound it may have made was lost in the noise I made, breaking the world's record for a standing backwards jump. It made for the hole in the mound but I got it with another large stone before it reached it. It was about 17 inches long.

This note may be of interest as regards the hibernating habits of these creatures. The day was warm in the sun and I presume its burrow was not far under the surface of the sand, the warmth of which had brought it out for a sun-bath.

ISLAMIA COLLEGE,
PESHAWAR.
January 8, 1933.

C. H. STROVER, B.A.

XXI.—OCCURRENCE OF *ZELTUS ETOLUS* NEAR CANNANORE, MALABAR.

I think it will interest members of the Society who are Entomologists to know that I took a ♂ '*Zeltus etolus* (Evans. H. 84) on the Matanur-Manantoddy road at mile 34 from Cannanore at 11 am. on 1st December. It was settling on damp earth in a quarry just off the road. Brigadier Evans gives its locality as 'Sikhim—Burma'. N.R. but Yates took it in Coorg. The spot where I took it is in Malabar, and a long way from the actual ghats, it was a perfect specimen evidently just hatched out. I saw another flitting about a tree out of reach, 20 feet from the ground, at the same spot about an hour later.

Cannanore, W. M. LOGAN HOME,
S. India. *Lt.-Col.*
December 9, 1932.

XXII.—OCCURRENCE OF *ACTIAS MÆNAS* DOUBL. IN TRAVANCORE.

During a short visit last year to Munar, Travancore, I was able to examine a small collection of *Lepidoptera* in the possession of the Rev. Shackle, mainly collected by himself in the Travancore Hills.

Among the specimens I was surprised to see a pair of *Actias* which seemed unaccountably odd to me. The male was a typical *selene*, but the female was enormous and quite different to any other specimen of that insect I had seen heretofore. Mr. Shackle has kindly given me the two insects for closer study and I am now able to see that the male is indeed a typical *A. selene* but the female, one of *A. mænas*. This latter insect, to my knowledge, has not been reported from south of the Himalayan tracts and Burma; Hampson giving its habitat as Sikhim, Bhutan, Khasi Hills and Sibsagar, Assam and Burmah.

The present specimen is a little rubbed but the greater part of the groundcolour remains and is a rich citron yellow; the lunule in the forewing extends to posterior of the 4th median nervure, viz, to through and beyond the discoidal cell; the antemedial and postmedial waved lines are very obscure but may have faded somewhat: the marginal pink bordering to wings is typical in the fore wings, and very heavy purplish in the hind and extending here to well beyond the middle of tails; the thorax and abdomen are unmarked. The expanse of this magnificent specimen is exactly 200 mm. as compared with 172 mm. given by Hampson. These differences are so slight as hardly to give a racial value to the insect.

Coimbatore. F. C. FRASER,
February 20, 1933. *Lt.-Col.*, I.M.S.

XXIII.—FLOWERING SEASON OF THE SPOTTED GLIRICIDIA (*G. MACULATA*).

In the article by Father Blatter and Mr. W. S. Millard on the Flowering Tree *Gliricida maculata* (*Journ. B.N.H.S.*, vol. xxxvi, No. 1, pp. 138-140) it is stated that this tree flowers between February and March.

But it is interesting to note that the tree is in profuse bloom in the Victoria Gardens at present (January). There are three trees in these Gardens, all in bloom, including two shown in the plates in the *Journal* with the article above referred to. The flowering spikes commenced to appear about the middle of November and the trees are in their perfect bloom now.

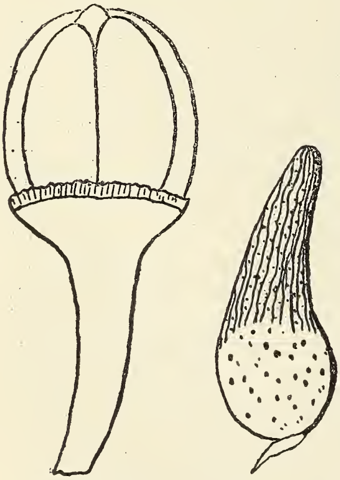
VICTORIA GARDENS,
BOMBAY.
January 6, 1933.

D. S. LAUD,
Superintendent,
Municipal Gardens.

XXIV.—FRUIT OF *CRYPTOCORYNE TORTUOSA* BLATTER AND McCANN.

(*With 2 text-figures*).

When in September 1930 we found at Mahableshwar *Cryptocoryne tortuosa* (*Araceae*) the plant was only in flower and we were not able to describe fruit (This *Journal*, vol. xxxv, p. 16.). On the 31st October 1932 one of us discovered the same plant in fruit. Whilst ⅔ of the flower was buried in the ground, the whole fruit was about 4 inches below the surface, and consequently quite white. The peduncle does not elongate in fruit. The syncarpium is subglobose, flattened on the adaxial side, 12 mm. long, 13 mm. diam. 5 or 6 ovaries are developed. The seeds are spindle-shaped, curved, 5 mm. long, almost 2 mm. broad at the base, longitudinally and irregularly verrucose-rugose. Of the twelve seeds in every ovary about 3-5 are fully developed. Albumen copious.



A. Fruit. B. Seed.

PANCHGANI.
November 2, 1932.

E. BLATTER, S.J., Ph.D., F.L.S.
C. McCANN, F.L.S.

XXV.—THE FLYING-FOX (*P. GIGANTEUS*) AND THE PALM SQUIRREL (*F. TRISTRIATUS*) AS AGENTS OF POLLINIZATION IN (*GREVILLEA ROBUSTA*, A. CUNN.) THE SILKY OAK.

(*With one block and 2 text-figures*).

The Silky Oak or Silver Oak, as it is frequently called, (*Grevillea robusta.* A. Cunn.) is commonly grown at Panchgani. It grows well, producing an abundance of flowers and fruit during the months of October and November.[1] To those who are not familiar with the tree, the popular names are somewhat misleading, as the tree is not an oak at all, but belongs to quite a different order; the *Proteaceae;* an order which is best represented in Australia.

Flowers of the Silky Oak (*Grevillea robusta* A. Cunn.).

The flowers of the *Grevillea* are peculiarly constructed. and appear to be provided by nature with the means of self-pollination if cross-fertilization is not effected. In bud, the exceedingly long style forms a big loop. The stigma, at its extremity, encompassed by the perianth, presses against the anthers. The anthers ripen before the stigma becomes erect. Once the style has left the embrace of the perianth, the latter splits into four parts and the upper portions become reflexed, exposing the open anthers on the under side of the brush-like inflorescence. The stigmas ripen some time after they have freed themselves from the grip of the tepals. Before leaving, the stigma carries along with it some of the pollen from the open anthers. The pollen grains are triangular in outline. Most of the pollen remains in the open anthers which are now turned downwards (see Fig. 1). Each flower secretes a fair amount of nectar which is held in position between the style and the perianth. To the taste the nectar is sweet. Nectar is the bait offered to flower visitors and honey eaters, who in their quest for the sweet liquid unconsciously aid plants in effecting cross-fertilization, which is considered to be of more advantage than self fertilization.

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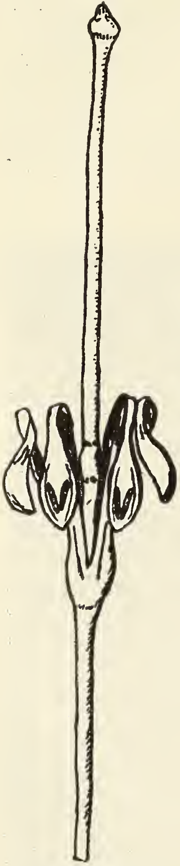
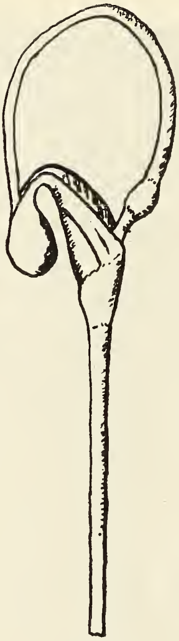
[1] I noticed many trees in flower again in April (1933).



Open Flower.



Bud.

Willis, in *Flowering Plants and Ferns*, 3rd. ed. (1908), p. 413, writes the following under the heading of the genus *Grevillea*:—'Trees and shrubs with leaves of various kinds and racemose infls., with 2 flrs. in each axil. The styles project from the bud as a long loop, the stigma being held by the perianth until the pollen is shed upon it. Then the style straightens out, and the pollen may be removed by visiting insects, the stigma not being receptive; presently the female stage supervenes, and if all the pollen has not been removed, autogamy may occur.

In a paper *On a case of Natural Hybridism in the genus Grevillea*, Musson and Fletcher [*Proc. Linn. Soc. of N. S. Wales*, vol. lii, (1927)], the authors suggest that birds are possibly responsible for cross-pollinating ". . . . the result probably being that a nectar-seeking bird visiting the flowers of one species may carry the pollen away from flowers of one part of the head, their position not matching with that of the receptive stigmatic surface of the other species. The result would be that cross-pollination of other flowers in the same or in other racemes of one type could take place, whilst in other species with raceme types differing it could not be effected.

Experimental investigation into these interesting details is much to be desired. At present we have little or no data for consideration." (l.c., p. 126).

It is quite clear from the above that little appears to be known with regard to the fertilization of the flowers of this genus. In order to make things clear I shall deal with the two different animal agents under their respective headings.

Flying Foxes: While at Panchgani, during the flowering season of the Grevilleas this year (1932), I noticed large numbers of these bats coming up from the valleys and concentrating their attention on the flowers of the Silky Oaks. Like most people, I was under the impression that the bats fed on the flowers. What puzzled me most, was that in spite of their regular nocturnal visits the amount of flowers on the trees did not seem to diminish. However, not being interested at the time, I gave the matter no further thought, until my wife persuaded me to shoot some Flying Foxes for the pot. Many had spoken of the savoury dish that could be made from these bats. They certainly proved to be quite good. However, this is not the place to speak of the Flying Fox as a table delicacy. As I had shot the animals, I turned my attention to the stomach contents to see what they really fed on. To my surprise I found that in all cases the stomachs were 'empty' with the exception of a quantity of nectar—the flowers were not touched. This investigation led me to review the situation from quite a different angle. Had the bats anything to do with the fertilization of the flowers?

I found that their faces were covered with a yellowish dust, undoubtedly pollen. A microscopical examination revealed that it was identical with that of the Grevilleas. Pollen was also present in the stomach, but that was not what the bats were after—it was the nectar.

Incidently, I might mention that none of the local trees were in fruit with the exception of the figs which still had a long time to go before they would be ripe. Bats, shot at different times of the night, showed nothing but nectar in their stomachs. It seems extraordinary that so large an animal could survive for several weeks on nectar alone and that collected by the 'drop' with considerable amount of trouble.

Having satisfied myself that the bats did not eat the flowers, I now commenced to observe them. With a powerful headlight and prismatic binoculars I kept a patient eye on the movements of the bats. I also shot several at different intervals for examination, and incidently for the pot when I had done with them. The binoculars soon convinced me that the bats first came in contact with the anthers and finally with the stigmas as they examined the flowers for nectar. The tongue of the Flying Fox is quite suitable for the extraction of nectar as it ends in a fine point.

As the bats pushed their snouts in between the flowers, commencing from the lower end of the raceme, their faces came in contact with the open anthers which were facing downwards, and as they raised their heads they brushed the stigmas. There appears to be little doubt that the pollen first shed by the anthers on the stigmas would be brushed away and fresh pollen substituted in its place, thus effecting cross-fertilization.

Examination of the bats that I had shot only went to prove my observations more substantially. The head was covered with pollen up to the ears, the sparingly hairy snout being licked clean by the tongue. The body and wings were also sprinkled with pollen, but there is no doubt that the face is the chief carrier which always came in contact with the styles.

The Palm Squirrel: During the day the Palm Squirrel replaced the services of the Flying Fox. Early in the morning they could be seen going through the racemes of flowers licking up what was left by the bats. The flowers appear to open during the hours of daylight, but I was not able to establish this point definitely.

The squirrels, like the bats, commenced from below the racemes and then crept over the inflorescence. In the case of the squirrels, the head and shoulders were dusted with pollen, so much so that the fore part of the animals appeared quite yellow. I have repeatedly watched these little animals moving about among the inflorescences of the Grevilleas.

Other visitors: I have frequently seen the short nosed Fruit Bat (*Cynopterus sphinx*) hovering about and around the Grevilleas but I have never seen one alight on the flowers. It is quite possible that this bat also feeds on their nectar, as it is one of the nectar feeding bats. In volume xxxv, p. 467, of this *Journal* I described the visits of this bat to the flowers of the Sausage Tree (*Kigelia pinnata*, DC.). Among the birds[1] I have seen the Jungle Crow (*Corvus macrorhynchus*) inspecting the inflorescences. There were also a number of small insect visitors, but I am of opinion that the bats and squirrels are of much more service than the insects.

BOMBAY NAT. HIST. SOC.,
BOMBAY.
November 30, 1932.

C. McCANN, F.L.S.,
Assistant Curator.

XXVI.—"BLUE" FLOWERS.

Mr. Singh's note on Scent in relation to Flower Colour.

Might I point out that none of the flowers he refers to can be said to bear *blue* flowers—the colour may have a blue base but none are blue like *Commelina sellowiana* for instance.

Caryopteris Wallichiana is a lavender blue, *Angelonia grandiflora* pale purple—*Passiflora laurifolia* has the actual petals white while the corona has a violet band.

Jacaranda mimosaefolia is blue with a violet tinge and the *Brunsfelsia* (*Franciscea*) *latifolia* and *Hopeana* violet blue.

S. PERCY-LANCASTER.

ALIPUR ROAD, ALIPUR, CALCUTTA.
December 6, 1932.

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[1] In the Journal of the *Linn. Soc. of N.S. Wales*, Vol. lviii (1933), p. 33, Mr. P. Brough has an interesting article on *The Life-history of Grevillea robusta* (Cunn.) in which he deals with the fertilization of these plants by birds (p. 65).

With reference to your letter dated the 9th. December, 1932, I wish to draw the attention of Mr. S. Percy-Lancaster (apart from my own personal observations) to pages 387, 415, 416, 502 of *Firminger's Manual of Gardening for India*, 1918 (Sixth Edition), Revised and edited by Dr. W. Burns, wherein it will be found that the species referred to in his letter (dated 5th. December, 1932) are possessed of blue colour. The flowers of *Jacaranda mimosaefolia* dependent chiefly on my observations at Lucknow and Cuttack, are of blue colour without any tinge of violet.

BOTANY DEPARTMENT, T. C. N. SINGH.
RAVENSHAW COLLEGE,
CHANLIAGANJ P. O.,
CUTTACK.
December 25, 1932.

XXVII.—INFLORESCENCE OF *ASTERACANTHA* NEES.

(*With one text-figure.*)

Asteracantha is a small genus, consisting of but one species *A. longifolia Nees*. By some authors it has been put under *Hygrophila* R. Br. and this is the position assigned to it by Hooker in the *Flora of British India* (4). More recent writers, however, have put it in a separate genus by itself and this is the rank given to it in the *Pflanzen-Familien* (3). The genus is distributed all over India, Ceylon, Singapore, Tropical and South Africa. Its habitat lies among ditches and swampy grounds and in such localities it is fairly common over the greater part of the country.

The genus is peculiar in the arrangement of its leaves in apparent whorls of six, in the presence of six spines at every node in the axil of these leaves and the arrangement of the flowers apparently in axillary whorls. On going through some of the Indian Floras, the writer found that the last feature, namely, the inflorescence, has been incorrectly described in some of them, as for instance, in Duthie's *Flora of the Upper Gangetic Plain* (3) and in Cooke's *Flora of the Presidency of Bombay* (1). The purpose of the present note is to bring this point to notice and to give a correct description of its parts.

Both Duthie (2) and Cooke (1) describe the flowers to be grouped 'in sessile axillary whorls of 8 (4 pairs) at each node, surrounded by rigid spines.' Lindou in *Pflanzen familien* (3) has given a more elaborate description as follows:

'Flowers in dense, abbreviated, cymose, axillary inflorescences, composed of thrice-branched dichasia. The central flower of the dichasium modified into long thorns, only that of the tertiary dichasium developed.'

So according to him also the number of flowers at a node would be eight. Really, however, the number of flowers at each node is much larger and the arrangement is not so simple as would appear from the descriptions given by the above authors. This is clearly brought out by the ground plan of a node sketched in the accompanying figure.

In the centre of the diagram is shown the quadrangular stem, ST and it bears two leaves, L_1 & L_2 in an opposite fashion. The presence of six leaves at a node in whorls is only apparent. These are really arranged in opposite and decusssate manner. Each of these leaves bears in its axil a branch as usual. These branches bear two leaves only, one L_3 & L_4 and the other L_5 & L_6 and are themselves modified into stout spines Sp_1 & Sp_2 opposite the leaves L_1 & L_2 respectively. The leaves of these axillary branches are so pushed out and pressed to the level of the leaves L_1 & L_2 that all the six leaves appear to be arranged in a single whorl.

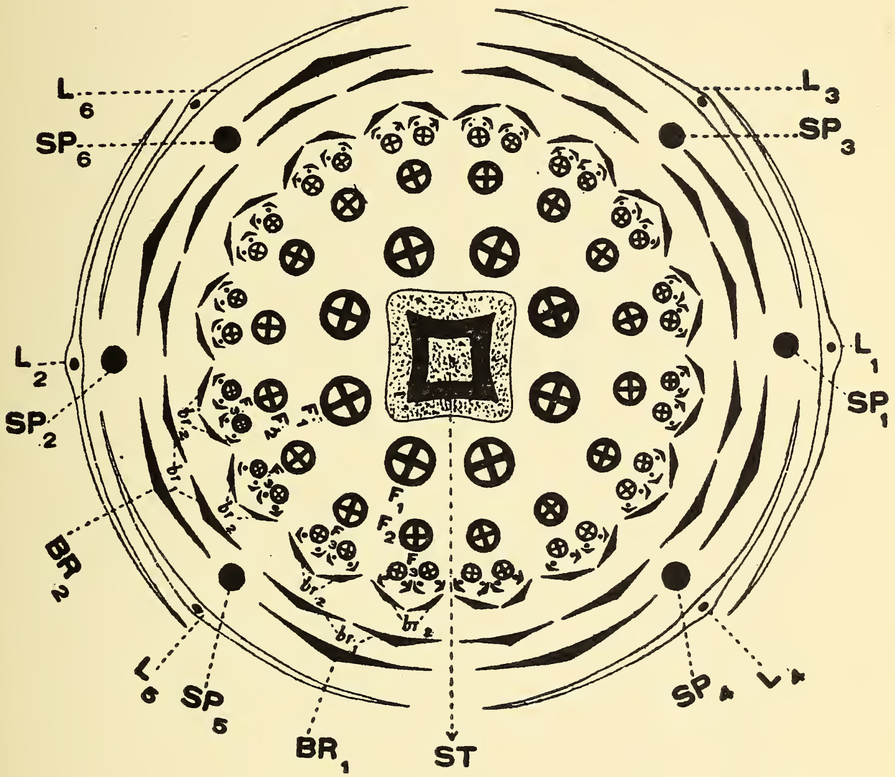
The rest of the structure can be described by considering the axilliary parts of one of the four leaves L_3, L_4, L_5 and L_6, as all these are similar in every respect. We may take for example the leaf L_5. Like the leaves L_1 and L_2, it bears a branch in its axil which ends in a stout spine Sp_5 and bears two leaves Br_1 & Br_2. The latter have been described as the bracts. Since there are four such leaves as L_5, there are four spines at a node, Sp_3, Sp_4, Sp_5 and Sp_6 in the axils of the leaves L_3, L_4, L_5 and L_6 respectively and these taken along with the spines Sp_1 and Sp_2 in the axils of the leaves L_1 and L_2, give the six spines which are characteristic of every node of *Asteracantha.*

The bracts, Br_1 and Br_2 in their turn again bear axillary branches each of which bears two foliar organs br_1 and ends in the flower F_1. Since there are only eight such bracts as BR_1 and BR_2, there are only eight flowers of the order F_1. The two foliar members br_1 act as the bracteoles for the flowers, F_1, but as bracts for the flowers of the next order F_2. These flowers of this set have again each two bracteoles br_2 which act like bracts for the flowers of the next order F_3. These flowers also possess two bracteoles but the buds in their axils were found to be undifferentiated even very late in the season. In the diagram these are represented by mere black dots.

The real situation then in *Asteracantha* is this. At every node there is a pair of opposite leaves and each of these bears a dichasial cyme in its axil. In the first two branchings the axes of the dichasia end in spines, in the subsequent ones in flowers. All the parts of the node are so much compressed and condensed that every thing, the leaves, the spines, the bracts and the flowers appear to be situated in whorls. There is no true distinction between bracts and bracteoles. Bracteoles of one flower act as bracts for those of the next younger set.

Another feature of the inflorescence of *Asteracantha* is that the flowers of the different sets do not develop simultaneously. A great deal of time, extending to some weeks, elapses between the opening of the flowers of one order and those of the next higher one. So there is a time when the flowers only of the order F_1 are in flower. Those of next order F_2 developing only perhaps after about 2 or 3 months when the former have reached the fruiting stage. This is probably the cause of the mistakes made by Duthie, Cooke, etc. In their material perhaps flowers only of the F_1 order were

ASTERACANTHA LONGIFOLIA.



1. ST—Stem.
2. L_1 and L_2—Outermost leaves of the node.
3. Sp_1 and Sp_2—Spines in the axils of the leaves L_1 and L_2.
4. L_3, L_4, L_5 and L_6—Leaves of the second set on the spines Sp_1 and Sp_2.
5. Sp_3, Sp_4, Sp_5 and Sp_6—Spines in the axils of the leaves L_3, L_4, L_5 and L_6 respectively.
6. BR_1 and BR_2—Bracts on the spine Sp_5.
7. F_1—Flowers of the first order in the axil of the bracts BR_1, BR_2, etc.
8. br_1—Bracteoles on the flowers F_1 and acting as bracts for the flowers of the next order F_2.
9. F_2—Flowers of the second order in the axils of br_1.
10. br_2—Bracteoles on the flowers F_2 and acting as bracts for F_3.
11. F_3—Flowers of the third order in the axil of the bracts br_2. Each of them has got 2 bracteoles, each with one undifferentiated bud in its axil represented by a small black dot in the figure.

developed and as there are only 8 flowers of this type two in the axil of every leaf L_3, L_4, and L_5 and L_6, they gave the description, flowers in axillary whorls of 8 (4 pairs).

A. C. JOSHI, M.SC.

Department of Botany,
Benares.
November 20, 1932.

Description of the Figure.

This figure shows the ground plan of one of the nodes of *Asteracantha longifolia*. What have been described as leaves are shown merely in outline, with the midrib marked by a large black dot. Spines are shown by black circles in the axils of the leaves. Stem is in the centre. Its vascular tissue is shown in black. Flowers are represented by circles with a cross inside. What have been described as bracts and bracteoles are shown in black to distinguish them from the leaves.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31st DECEMBER 1932.

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THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1932.

The Society's Journal.—The Thirty-fifth Volume of the Journal was completed and Part I of Volume XXXVI was issued during the year under review.

Scientific Papers.—*Mammals.*—Mr. R. I. Pocock continued during the year his important contributions on Indian Mammals which have become a feature of the Journal during recent years. His papers constitute a revision of various families and genera based on all the records and data now available and form an important preliminary to the publication of the new edition of the Mammalia of India in the *Fauna of British India* Series, which Mr. Pocock is engaged in writing in collaboration with Mr. Martin Hinton.

Papers published during the year deal with the Brown and Black Bears of Europe and Asia and the Rhesus Macaque (*Macaca mulatta*). In Part I of his paper on the Bears the author gives the distinguishing characters of European and Asiatic Brown and Black Bears and provides analytical keys for determining the four genera. Seven races of Brown Bear (*Ursus arctos*) are recognised by him. The author is unable to give subspecific rank to the various supposed races or species of the European Brown Bear. Individual variation in the size and shape of the cranium or teeth in specimens from the same or adjoining districts is very striking and shows the untrustworthiness of these characters which have been used by systematists for the differentiation of the European Brown Bears into species and local races. As regards the so called Burmese Brown Bear, described by Thomas under the name *Ursus arctos shanorum,* this race is known from a single specimen alleged to have been obtained in the Shan States, Burma. It was sent to the British Museum by the Indian Museum, Calcutta, and was originally received from a dealer in Wild Animals. Mr. Pocock doubts the correctness of its alleged origin as no brown bears have been recorded from any locality near the Shan States. The Brown Bear of Thibet (*U. arctos pruinosus*), whose general colour is blackish, seems to be nearly allied to the Manchurian race but its claws are typically pale horn-coloured and not black and, while the skull is on the average smaller, it is furnished with relatively larger teeth. The Kashmir Brown Bear (*Ursus arctos isabellinus*) ranges from the Thian Shan Mountains to the Western Himalayas and probably Hindu Kush. It is a well-marked race. The material available indicates that the Kashmir Bear may be white, silvery-grey, red or brown, the range of colour being from the Polar Bear to that of the dark European Brown Bear. The race is distinguishable by its smaller skull and teeth apart from differences in colour which separate it from the 5 other races of this species which occur beyond Indian limits.

In Part II of his paper the author deals with the Sloth Bears (*Melursus*), the Black Bears (*Sclenarctos*) and the Malay Bears (*Helarctos*). The author recognises two races of the Sloth Bear—The Indian and the Singhalese. He states that the Singhalese race has a shorter and much less shaggy coat than the Sloth Bears of Northern and Central India. He believes it probable that the South Indian Sloth Bear will prove inseparable from the Singhalese form, but in the absence of any skins and skulls the author is unable to draw definite conclusions. Skins and skulls of Sloth Bears from South India are required for comparison. Mr. Pocock recognises 7 races of the Black Bear (*Selenarctos thibetanus*). The geographical limits of the typical race—the Himalayan Black Bear (*Selenarctos t. thibetanus*) range apparently from the Nepal Terrai eastwards through Assam, Burma, Siam, Annam and probably Southern China. The author establishes a new race for the Kashmir Black Bear under the name (*Selenarctos thibetanus laniger*) and distinguishes it from the more eastern form by its longer, softer and altogether more luxuriant coat and heavy under-fur. To the Black Bear of Baluchistan he temporarily gives the subspecific name *gedrosianus*. The name was originally applied by Blanford to two distinctly 'brown' skins obtained at Tump, which he at the time believed to represent a distinct species. Blanford subsequently concluded that the Baluchistan Bear was little more than a race of the Himalayan Black Bear. Mr. Pocock provisionally admits this race which is said to be smaller in size and, while its coat is apparently the same as in the typical race, the colour is a very dark brown, or rufous brown as indicated in the skins obtained in Mekran.

So much for the Indian races of this bear. The remaining 3 races recognised by the author occur in China, Manchuria, Amurland and the mountainous parts of the Japanese Archipelago.

The Malayan Bear (*Helarctos malayanus*) is distinguished from the Himalayan species mainly by its shorter and broader head, its small rounded ears, its modified rhinarium and more protrusible lips and tongue. A perusal of Mr. Pocock's papers will indicate the scanty nature of the material available in the collections both in India and in England. Will members of the Society who have the opportunity help by sending skins and skulls of Bears either to the British or the Society's Museum.

Mr. Pocock's second paper deals with the Rhesus Macaques (*Macaca mulata*). Though a common and familiar species this monkey has never been adequately studied from the point of view of individual, seasonal, or local variation. The colouration varies considerably even among individuals from the same area and this character is useless for determining racial differences. The condition of the coat is also subject to seasonal change. It is at its best between November and February. During the hot weather it wears a dead and shabby look till the moult which apparently occurs during June and July. In the author's opinion several races of this Macaque are recognizable. Within our limits he establishes three. The typical race occurs in Northern and Central India, through Assam and Upper Burma, extending eastwards to Annam. A West Himalayan form is found in Kumaon, the northern districts of the Punjab and Kashmir. To this race the author ascribes the subspecific name *villosa*. It is a heavier, and on the average slightly larger, monkey, but the differences are not very marked and there is no doubt that the Kashmir race intergrades with the typical race at the lower levels. The Macaque which inhabits the warmer parts of Kafristan and the lower end of the Chitral Valley is apparently even larger than the Kashmir form. It is also less brightly coloured and more dusky olive in tone. To this third race the author ascribes the name *macmahoni* after Sir Henry Macmahon, an old member of the Society, who founded the Quetta Museum. Three other races are recognised which occur outside our limits.

Birds.—Three papers dealing with the bird collections made during the Vernay Scientific Survey of the Eastern Ghats were published during the year under review. The author Mr. H. Whistler, who is being assisted by Mr. N. B. Kinnear of the British Museum, published an introductory account of the genesis of the survey in Volume XXXIV of the Journal. The Madras Presidency is the least known part of India from the viewpoint of its Ornithology and the report of the Survey is written in the form of an account of the birds of the Madras Presidency and mentions all the species hitherto recorded from the area whether they have been met with by the Survey or not. The authors further deal with the species from the standpoint of their general distribution within the boundaries of British India. From a careful study of all published records, the collections made available by the Survey, and through other sources they have set themselves the task of revising the hitherto recognised geographical races of the species they deal with. In many instances they have been compelled to differ from the conclusions arrived at in the *New Fauna*. A perusal of the papers so far published emphasises how much still remains to be learnt about Indian Birds, especially as regards their distribution, migration and local movements. The distribution of even our commonest species is imperfectly known. The Report helps to indicate what deficiencies remain to be filled and how exactly local observers can help to fill them.

Ornithologists in India owe a deep debt of gratitude to Mr. A. S. Vernay whose generosity made this important survey possible.

The thanks of the Society are due to the authors, Messrs. Whistler and Kinnear. The painstaking thoroughness and the great care that they have devoted to the preparation of the report have made it one of the most important contributions to Indian Ornithology of recent years.

Mr. S. A. Ali contributed a paper on 'Flower Birds and Bird Flowers' in India. The importance of bees, butterflies and other insects in the cross fertilisation of flowers is well known, but the significance of birds as fertilizing agents has been consistently underrated. It is a subject which has received little attention from workers in India. The present paper is possibly the first comprehensive contribution to the subject as regards Indian species. The author gives a list of flowers observed to be visited regularly by birds in India and under each species records the species of birds which visit them. 36 species of trees are mentioned representing various orders and families. The number is supplemented with a further list of 16 species, indigenous or introduced, which have been recorded as partly or entirely ornithophilous. Fifty-two species of birds are recorded as regular visitors to the flowers of these trees. In addition to habitual honey feeders such as the Sunbirds, Flower-peckers and White-eyes, which are structurally adapted to this method of sustenance, the list includes a number of species which, without being specially equipped for the purpose, are nevertheless regular nectar seekers. The paper provides the basis of an interesting field of investigation for workers in India and forms a useful guide to what has hitherto been ascertained or partly ascertained and the lines on which further research should be conducted.

Reptiles and Amphibians.—Dr. Malcolm Smith, who is revising Boulenger's volume on the Reptilia in the *Fauna of British India* Series and whose first volume dealing with the Crocodiles and Chelonians was published in 1931, contributed an article on Indian Monitors. A critical examination by the author of specimens in the British Museum and in the collections at Bombay and Calcutta indicated the necessity of revising the distribution of several species as given in Boulenger's *Fauna*. The paper further amends Boulenger's key to the identification of the species, and provides one which will be found more practicable to field workers who have not the advantage of adequate material for comparison.

Dr. Norman Corkhill, late of the Iraq Health Service, published a paper on Snakes of Iraq which supplements the previous contributions on the subject in the *Journal* by Dr. Boulenger and the late Miss Proctor. A very interesting paper on Indian Batrachians by C. McCann, Assistant Curator of the Society, was published during the year. The author contributes notes and observations on the life history and habits of species which, in the majority of cases, were reared by him from spawn. Mr. McCann's observations on the breeding habits of the Chunam Frog (*Rhacophorus malabaricus*) are particularly interesting since they imply a unique departure from the normal methods of fertilisation of the ova, known to exist among frogs. In the present case, a female in captivity produced, in the absence of the male, fertilised ova from which tadpoles subsequently emerged. The author submits the theory that with this particular species amplexus takes place previous to the actual discharge of the ova, the departure being due to the peculiar situations in which the ova are laid. Their fertilization at the time of their discharge may be effected by spermatozoa deposited and carried on the body of the female. Further investigations are necessary to prove the correctness of the theory.

Fishes.—A paper 'On Fishing for Bombay Duck' (*Harpodon nehersus*), indicating the destructive methods now in use in netting them, was contributed by Dr. Setna of the Royal Institute of Science, Bombay. The Bombay Duck is one of the more important economic species of Western India. It forms an important source of food supply to the poorer classes. The author indicates that the type of nets in use for the taking of these fish results not only in the capture of fishes of all sizes and all stages of growth but also in the wastage of thousands which are crushed and rendered unsaleable.

Molluscs.—During the year we published the first part of Mr. Rai's Report on the Survey of the Shell Fisheries of the West Coast, recently undertaken by him on behalf of the Society. The author visited the principal shell fishery centres on the Bombay and Sind Coasts, where he studied the economic conditions under which the Industry is being carried out with a view to suggesting measures for their improvement. Part I of Mr. Rai's report deals with the Molluscs. Dealing with the Oyster Fisheries, Mr. Rai shows that the supply of oysters is at present unequal to the demand. A survey of the oyster beds in Sind and in the Ratnagiri Districts has shown that immense harm has been done to the beds and continues to be done by crude and unregulated methods of fishing. Beds which formerly produced an excellent supply have been completely destroyed. The Clam fisheries are perhaps of even greater importance. They provide a cheap and nutritious food, particularly during the monsoon, when fish is scarce, and give employment to a very large number of people. The total production of this type of shell fish (two genera are mainly involved—*Tapes* and *Meretrix*) is estimated at 4 million pounds per annum at the approximate value of Rs. 1,02,000. The report gives data relative to species of economic importance and furnishes information as regards the distribution of the Clam Beds and the fishing and marketing of clams. As in the case of the oysters, the methods in vogue are wasteful and result in the destruction of enormous quantities of shell-fish. Specific measures are recommended for the greater conservation of the resources of the Clam and Oyster Fisheries which, with some regulation and the introduction of improved methods, could be placed on a very much more satisfactory basis. These measures include the introduction of legislation against indiscriminate fishing, the fixing of a close season, prescription of a size limit and, finally, measures for the improvement of the sources of supply. The report further stresses the necessity for investigations relative to the species which are of economic importance so as to provide data essential to the development of the Industry.

In 1931 the Government of Bombay deputed one of their officers to investigate and report on the Fisheries of the West Coast. The report we understand is shortly to be published and we await its recommendations. There is abundant need for the better control and regulation of our fisheries and for improvement in methods of fishing and marketing. But until it is possible to establish in Bombay a department whose special purpose will be the care and development of the fishing industry; whose aim will be to carry out continuous research and investigation so as to be in a position to recommend those beneficial measures essential to its development, our fisheries, which are of undeniable importance to a maritime population, must continue in their present condition of oblivion and neglect.

Insects.—Part III, being the conclusion of Mr. Rhe de Philipe's paper on the Butterflies of the Simla Hills, was published during the year under review. We were also able to publish an important paper by Brigadier W. H. Evans on the 'Butterflies of Baluchistan'. The only previous contribution to this subject was a paper published by Col. Swinhoe in 1895. The present paper lists 108 species as occurring in Baluchistan which is a considerable advance over the 48 mentioned in Swinhoe's list. It includes several new races and species and a number of forms previously unknown to occur within Indian limits. Brigadier Evans' collecting days in India are over, but it is fortunate that he was able to close his career of 38 years in India in such a fascinating and interesting country as Baluchistan. We take this opportunity of expressing to him the thanks of the Society for the continuous assistance that he has given it in all matters relating to his special subject and we are glad that he proposes to maintain his long and valued connection with us although he has left India.

During the year we published Part XL of Lt.-Col. F. C. Fraser's paper on Indian Dragonflies. The serial commenced 16 years ago in the Journal and has continued practically without interruption up to date. Its purpose was to provide systematic descriptions of the families, genera and species of Dragonflies occurring within the Indian Empire and now includes descriptions of a large number of new genera and species since established mainly as a result of the author's researches. Lt.-Col. Fraser has been commissioned to write the new volume on Dragonflies in the *Fauna of British India* Series and, as this will imply duplication of work, he suggests that the serial in its present form should be discontinued. Such papers as are published in future will be limited to revisions where necessary and to notes on the distribution or habits, etc., of species.

The thanks of the Society are due to Lt.-Col. Fraser for his important contributions to our Journal. In their scope they are at present the only comprehensive account of the Odonate fauna of the country and we take this opportunity of congratulating him on his selection to carry out a work for which he is eminently fitted.

Further observations on the Freshwater Medusa (*Limnocnida indica*) form the subject of a paper by H. Srinivasa Rao of the Zoological Survey of India. Since its sensational discovery in the Satara District by Professor Agarkhar in 1911 various attempts have been made to investigate the life history of this Hydroid, which, however, remains obscure. The present paper gives an account of the habits and habitat of the Freshwater *Medusæ*, comments on the present distribution of the genus and discusses its origin in India from data made available by geological evidence.

Botany.—During the year we published Parts XVII, XVIII and XIX of Rev. Father Blatter's Revision of the Flora of the Bombay Presidency. The parts deal with the Orchids and were written in collaboration with Mr. McCann. They include descriptions of several new species and make a number of additions to the Flora of the area.

A new species of Gentian discovered by Capt. D. G. Lowndes in N. Waziristan was described by Fr. Blatter.

In an editorial note published with the second issue of the *Journal* in 1932 we offered our congratulations to Fr. Blatter on his being awarded the Johannes Brühl Medal by the Royal Asiatic Society of Bengal in recognition of his conspicuously important contributions to the knowledge of Indian Botany. In spite of very indifferent health Fr. Blatter has continued his researches and we hope that he will be spared for many years to continue his great services to Indian Botany.

Popular Articles.—During the year under review we published Parts VI, VII, and VIII of Mr. Stuart Baker's popular serial on Indian Waders which when completed will form the 5th volume of his work on the Game Birds of India.

Parts VIII, IX and X of the serial on Beautiful Indian Trees by Rev. Fr. Blatter and Mr. W. S. Millard were issued during the year. Unfortunately owing to the need for reducing costs it has been found necessary to publish only one coloured plate with each part instead of two. This will extend the publication of this interesting serial over a longer period than was originally anticipated. It is intended eventually to issue the papers in book form.

Our thanks are due to Mr. Stuart Baker, to Father Blatter and Mr. W. S. Millard for these contributions which add so much to the interest and attractiveness of the Journal.

An article on the Game Fishes of the Bombay Presidency was written by Sir Reginald Spence and S. H. Prater. It gives general information as to the fishing localities in and around Bombay and the neighbouring districts, provides descriptions of the common game fishes of local reservoirs, lakes and streams and indicates the species which might be introduced, and recommends measures necessary for the improvement of conditions in local waters. Thanks to the generosity of Mr. F. V. Evans the Society was able to illustrate the article with 14 coloured plates. Separate copies of the article are available.

The Society is anxious to develop the popular side of the *Journal* and would welcome contributions from members on subjects dealing with Sport and Natural History. Unfortunately the Society is not in a position to pay for contributions and so loses many interesting articles by writers of merit who otherwise might have contributed to its pages. But our *Journal* has been dependent since its inception upon voluntary contributions by members of the Society and the position which it holds to-day redounds greatly to the credit of those who have helped the Society by their voluntary work. We appeal once more to members to continue to send their notes and observations to the *Journal* and to induce their friends to do so. We should be glad to receive any suggestions which would help to add to the interest and attractiveness of the *Journal*.

Preservation of the Fauna of India.—We are glad to be able to announce that we propose to issue shortly in the *Journal* a series of articles dealing with the preservation of the fauna of this country. They are being written by various authorities with intimate knowledge of game conditions in different provinces. As an accompaniment to this series we propose to issue a serial on the Mammals of the Indian Empire which will be profusely illustrated in colours and black and white. Mr. F. V. Evans, a Vice-Patron of our Society and one of its most generous benefactors, has very kindly offered to pay the cost of illustrating these articles. His Excellency the Viceroy has very kindly consented to write a foreword to this series. Its purpose is to awaken interest in India on the subject of the preservation of its fauna. It is felt that much of the apathy in this respect is due to ignorance and we believe that the first essential step is the spread of information among people regarding the beautiful and varied fauna of the country and the need for its conservation. The Society intends eventually to issue these papers in pamphlet form and to distribute them as widely as possible.

Publications.—The Society issued during the year a second edition of Brigadier Evans' *Identification of Indian Butterflies.* The book is a revised and enlarged edition and contains much new data.

During the year it was decided to issue in book form the coloured illustrations of Indian Birds, recently published by the Society in the form of charts. It is believed that in this form they will be more convenient for individual use. A limited number of copies have been bound and are available.

Expeditions and Explorations.—The Society was able during the year to undertake an Ornithological Survey of Travancore State. The Vernay Survey of the Madras Presidency emphasised the need for further study of the Birds of the South Indian Region particularly of Travancore. The Society was again fortunate in securing the services of Mr. Salim A. Ali who volunteered to carry out the work. Our grateful thanks are due to His Highness the Maharaja of Travancore for a grant of Rs. 2,000 made by him towards the cost of the expedition and to his officers for the assistance they gave us.

An expedition was undertaken on behalf of the Field Museum, Chicago to Kheri, Garhwal and the Abu Hills to collect material for Museum Groups. Mr. C. McCann was in charge and remained in the field from January to April. Our thanks are due to Capt. L. D. W. Hearsey, for the assistance which he gave the expedition.

Expenditure and Receipts.—The total anticipated income of the Society for the year 1932 was Rs. 36,343-6-4. Actual receipts amounted to Rs. 35,549-11-11 as compared with Rs. 40,312-4-6 during 1931 showing a drop of Rs. 4,762-8-7.

The drop in revenue is mainly due to reduced receipts under the following:—

	1931. Rs.	1932. Rs.
Annual subscription	25,800	23,552
Sales of Game Books	2,240	942
Entrance Fees	950	678

The reduction in receipts was partly made up by increased revenue under the following item:—

	1931. Rs.	1932. Rs.
Sales of Journals	1,072	2,272
Life Membership	350	1,050

The following figures show comparatively the number of members on the roll of the Society (excluding Life Members) on the 1st. of January 1932 and 1933 and the number who paid their subscription during the year:—

	No. of Members on Roll.	No. of Members who paid subscription.
1932, 1st. January	1,024	961
1933, 1st. January	963	893

As indicated in the Circular issued to members early in 1932 the Society is passing through a critical period owing to the difficult conditions which now prevail.

During the past three years it has lost 325 members from resignations, while new members for this period amount to 193 showing an adverse balance of 132. To a Society depending for its income entirely on the support of members this loss is serious. By retrenchment and in other ways the Society is doing all that it can to tide over these lean times and yet to continue its work and maintain the high standard of its *Journal*. The various numbers issued during 1932 will indicate this.

The year 1933 is the Jubilee year of the Society in which it completes 50 years of continuous progress. To enable the Society to continue what it is so successfully doing it requires the generous support of its members. This help they can give most effectively by continuing their membership and inducing their friends to join. We would greatly appreciate the active co-operation of members at the present time.

Staff.—The Committee take this opportunity of placing on record their appreciation of the services of the Curator and his staff whose labours have enabled it to continue and maintain the standard of its work under the difficult conditions which prevail at present.

P. M. D. SANDERSON,
REGINALD SPENCE,
Joint Honorary Secretaries.

13*th March*, 1933.

BOMBAY NATURAL HISTORY SOCIETY

BALANCE SHEET AS AT 31st DECEMBER 1932.

LIABILITIES	Rs A P	Rs A P
Life Membership Fees	......	47,150 0 0
Donations for specific objects unexpended :		
Show Cases, etc. in existing building ...	2,253 2 10	
Show Cases in new building	16,313 11 3	18,566 14 1
Sundry Creditors :		
Printers of Journals	4,836 6 2	
,, ,, Game Books, Vol. III ...	1,333 5 4	
,, ,, Bird Charts	1,791 1 9	
For Expenses	250 0 0	8,210 13 3
Surplus Assets—		
Balance as per last Balance Sheet ...	21,407 3 11	
Fluctuation in the value of Securities ...	14,870 0 0	
Add : Surplus on Revenue Account ...	1,060 2 0	
,, ,, Publication Account ...	185 9 3	37,522 15 2
Total ...		1,11,450 10 6

ASSETS	Rs A P	Rs A P
Investments at par or market value on 31st December 1932, whichever is lower :		
Rs. 28,000 Govt. 3½% Pro. Notes at Rs. 74.9/16%...	20,877 8 0	
,, 10,000 ,, 4% Con. Loan at Rs. 98½%	9,850 0 0	
,, 15,000 ,, 5% 1944-55 at par. ...	15,000 0 0	
,, 8,000 ,, 6½% Bom. Dev. Loan 1935 at par. ...	8,000 0 0	
,, 14,000 Port Trust 4% Bonds at 77% ...	10,780 0 0	
,, 15,000 Imp. ,, 4% ,, at 76% ...	11,400 0 0	75,907 8 0
Investments on account of Show Cases in New Building :		
Rs. 10,000 Govt. 6% 1933-36 at par. ...	10,000 0 0	
,, 500 ,, 5% 1944-45 ,, ...	500 0 0	
,, 5,700 ,, 5½% 1938-40 ,, ...	5,700 0 0	16,200 0 0
Cash—		
With National Bank of India Ltd., in Current Account	2,288 3 0	
With National Bank of India Ltd., London £25-17-10 at 1/6	345 3 7	
On hand	150 0 0	2,783 6 7
Sundry Debtors	...	1,641 3 0
Loan to Staff	...	225 0 0
Furniture	1,815 0 0	
Less Depreciation	100 0 0	1,715 0 0
Publications, excluding Journals : As certified by the Secretary ... ... *Note.*—Any publications which have been on hand over 2 years have been written off.	...	400 0 0
Game Books, Vol. III : Stock on hand as certified by the Secretary	...	1,466 0 8
Bird Charts, Stock on hand as certified by the Secretary	...	7,819 14 8
Bates' Bird Life, Stock on hand as certified by the Secretary	...	1,295 0 6
Beautiful Indian Trees : Stock on hand as certified by the Secretary	...	1,246 6 3
Butterfly Book : Stock on hand as certified by the Secretary	...	751 2 10
Total ...		1,11,450 10 6

Note.—A stock of 18,200 old Journals and the Valuable Research Collection and Library of 2,500 volumes have not been taken into account on the Asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the cash book and from information given to us, and have verified the investments.

In our opinion, such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and explanations given to us.

BOMBAY, *March 3, 1933.*

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) A. FORRINGTON,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1932.

	Rs A P	Rs A P		Rs A P	Rs A P
To Salaries	14,093 11 6		By Subscriptions	23,725 11 8	
,, Society's Contribution to Provident Fund	1,593 0 0		,, Entrance Fees	658 5 4	
,, General charges	501 3 5		,, Sales of Journals	2,272 0 7	
,, Rent	2,436 0 0		,, Interest	4,515 15 10	
,, Printing and Stationery...	331 5 9		,, Taxidermy Department	572 0 8	
,, Postage	1,234 6 5		,, Sales of Games Book, Vols. I & II.† ...	812 0 0	32,556 2 1
,, Library	160 1 5				
,, Audit Fee	250 0 0				
,, Fire Insurance	100 0 0				
,, Furniture depreciation	100 0 0				
,, Cost of Journals	10,696 3 7				
,, Surplus carried to Balance Sheet ...	1,060 2 0	32,556 2 1			
Total ...		32,556 2 1	Total ...		32,556 2 1

† Total Cost Rs. 65,520-10-8. Of this amount Rs. 60,921-7-11 was received from Sales of Books and Rs. 4,599-2-9 were paid to Publisher out of Revenue.

N.B.—The Sales made during the year have been credited to Revenue because the cost was paid from Revenue. We still have to recover Rs. 4,599-2-9 from further sales before we have cleared expenses.

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1932.

	Rs A P	Rs A P		Rs A P	Rs A P
To Balance carried to Surplus Assets ...		185 9 3	By Snake Charts	104 4 0	
			,, Snake Books	21 14 3	
			Society's Publications	59 7 0	185 9 3
,, Stock of Game Book, Vol. III on 1-1-1932...		2,137 2 5	,, Sales of Game Books, Vol. III	671 1 9	
			,, Stock on hand	1,466 0 8	2,137 2 5
,, Stock of Bates Bird Life on 1-1-1932 ...		1,532 3 6	,, Sales of Bates' Bird Life	237 3 0	
			,, Stock on hand	1,295 0 6	1,532 3 6
,, Printing of Butterfly Book		1,395 2 10	,, Sales of Butterfly Book	644 0 0	
			,, Stock on hand	751 2 10	1,395 2 10
,, Stock of Bird Charts and Albums on 1-1-1932	9,122 3 4		,, Sales of Bird Charts and Album† ...	3,127 8 0	
,, Printing of Bird Albums	1,825 3 4	10,947 6 8	,, Stock on hand	7,819 14 8	10,947 6 8

† Total expenses on charts and albums to date Rs. 28,026-12-0. Of this amount Rs.26,235-10-3 have been paid to Printers and others. Still due to Printers for Albums Rs. 1,791-1-9=Rs. 28,026-12-0.

Sales of Charts and Albums to date ... (This amount has been remitted to Printers, etc.)	Rs. 20,206-13-4
Value of Stock in hand.	,, 7,819-14-8
	Rs. 28,026-12-0

BOMBAY NATURAL HISTORY SOCIETY

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER 1932.

	Rs a p		Rs a p	Rs a p
To Expenditure on Show Cases, Modeller's salary and Field Museum collecting expenses	9,560 0 6	By Unexpended balance for Show Cases, as per last Balance Sheet	2,813 3 4	
,, Balance carried to Balance Sheet	18,566 14 1	,, Unexpended balance for Field Museum collecting expenses as per last Balance Sheet	7,000 0 0	
		,, Unexpended balance for Show Cases in New Building as per last Balance Sheet	15,225 10 0	
		,, Donations for Modeller's salary, &c. ...	2,000 0 0	
		,, Interest on Building Fund Investments...	324 1 0	
		,, Fluctuation in value of Securities ...	764 0 3	28,126 14 7
Total ...	28,126 14 7	Total ...	...	28,126 14 7

BOMBAY, *3rd March, 1933.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) A. FORRINGTON,
Honorary Treasurer,

PRINTED AT THE DIOCESAN PRESS, MADRAS, AND PUBLISHED BY
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FOR SALE

British Museum Catalogue of Birds 27 Volumes, **Hand-List** 5 Volumes, **Catalogue Eggs** 5 Volumes; in all 37 Volumes	£	**45**
'Ibis' Complete with all Supplements, Extra issues, General indices, etc. Bound red Morocco. An exceptionally fine set	,,	**120**
Novitates Zoologicæ XXXVI Volumes complete from start	,,	**45**
Jerdon's Illustrations—Indian Ornithology.	,,	**7**
Journal – Siam Natural History Society 8 Volumes, all presented	,,	**5**
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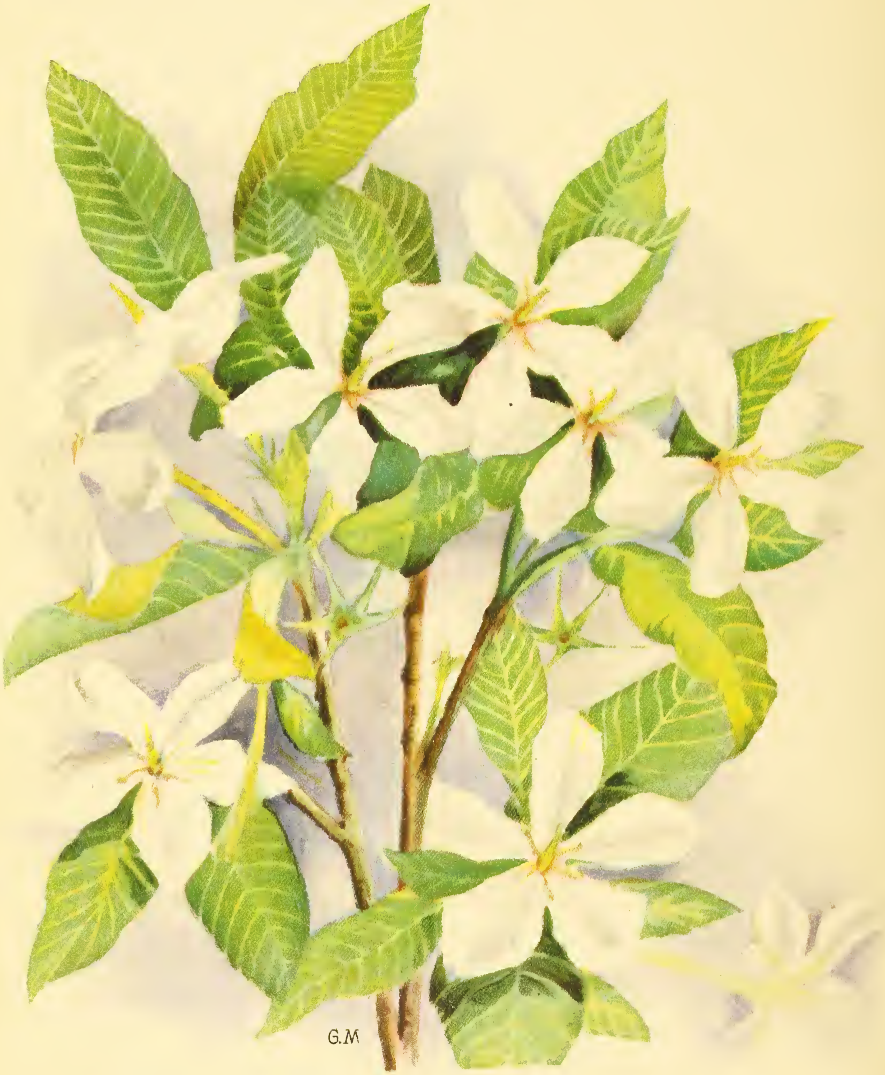

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THE BRILLIANT GARDENIA.
Gardenia lucida, Roxb.
(about ½ nat. size)

Note.—

GAME BIRDS OF INDIA.

The concluding parts of Mr. Stuart Baker's serial on Indian Semi-Sporting Birds will appear in the next issue.—Eds.

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DECEMBER, 1933. VOL. XXXVI. No. 4.

SOME BEAUTIFUL INDIAN TREES.

BY

E. BLATTER, S.J., Ph.D., F.L.S., AND W. S. MILLARD, F.Z.S.

Part XIII.

(With one coloured plate, one black and white plate and 3 text-figures).

(Continued from page 523 of this volume).

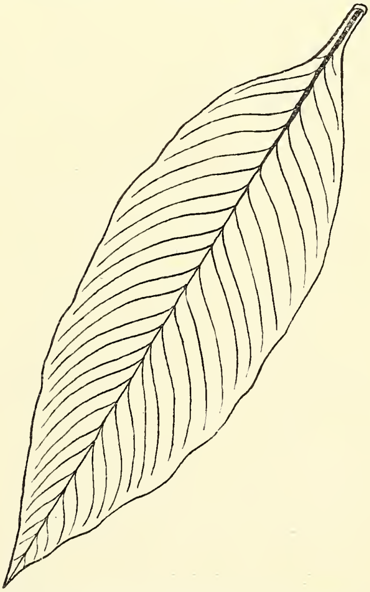
PLATE XXI. THE BRILLIANT GARDENIA.

Popular Names: Dikamali (Hind.); Konda manga, kokkita, tetta manga, kuru (C.P.); Dikamali (Mar.); Dikamali (Guz.); Papar (Bijeragogarh); Kumbi (Tam.); Karinga, karaingi, karung, tellamanga, china karinguva (Tel.).

Popular Names of the Gum-Resin: Dikmali (Hind.); Dekamali (C.P.); Dikamali (Bomb.); Kumbai, dika-malli (Tam.); Tella-manga, chinaka-ringuva (Tel.); Dikke-malli (Kan.); Kolalakada (Sing.); Kunkham (Arab.).

Gardenia lucida. Roxb. Hort. Beng. (1814) 15.—*G. resinifera* Roth. Nov. Sp. 150.—Belongs to the family Rubiaceae. *Gardenia* was named so after Alexander Garden, M.D., of Charleston, S.C., a correspondent of Linnaeus; *lucida* means shining, brilliant.

Description. A large smooth shrub or small tree reaching 20-25′ in height. The bark is smooth and grey, when young greyish green. Shoots are smooth and shining and covered with a thin yellowish coating of resin which frequently forms globules at the tips. The leaves vary from 2½-8 long by 1-3″ broad. They are elliptic-oblong in outline,



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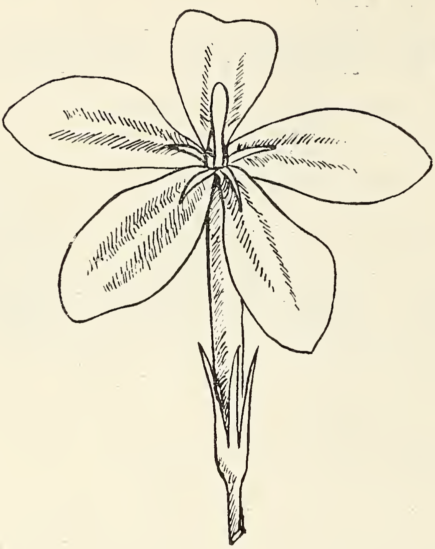
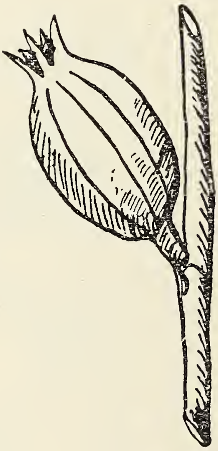


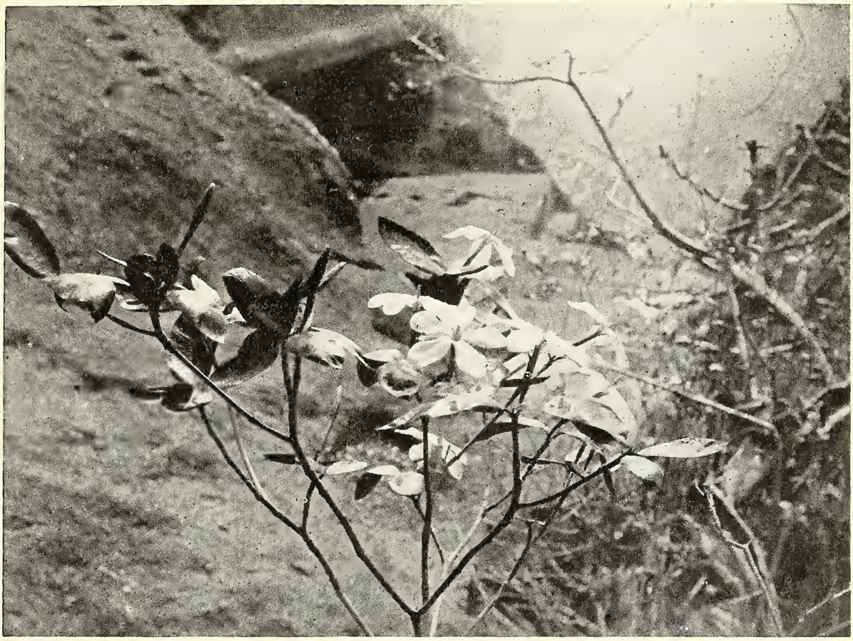
with partially blunt or fine pointed tips. The base of the leaf is narrowed into the short leaf stalk. The slender main nerves of the leaf are prominent on the underside. The stipules between the opposite leaves are large, broadly egg-shaped, pointed and thin in texture. The flowers are large and fragrant. They rise singly in the axils of the uppermost leaves near the extremities of the branches; the flower stalks vary from ¼-½″ in length. The calyx is ¾″ long and softly hairy, the teeth are 3/8″ long, erect, lance-shaped and tapering to a fine point. The corolla is large, pure white on opening, soon turning yellow, the tube is 1¼-2″ longer slender, covered with fine hairs on the outside. The five petals are obovate, blunt, 1¼-¾″, spreading, veined and smooth. The fruit is elliptical or rounded in outline, ¾-1″ in diameter, smooth, marked with longitudinal lines and crowned by the persistent calyx, the outside is thick and woody. The flowers open in the evening, soon turn from white to yellow and die (Cooke).



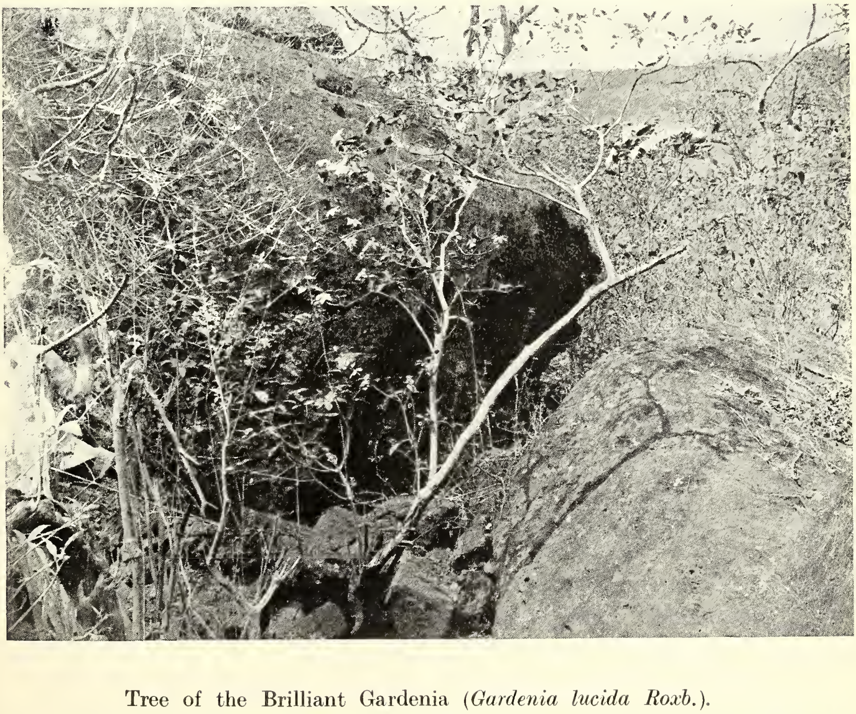
Distribution: Growing wild in Burma, Chittagong, from the Konkan southwards, N. Kanara, Deccan and Carnatic, in deciduous forests in all the dry districts of the Madras Presidency.

Gum-Resin: The remarkable gum-resin, *dikamali*, or *cumbi*-gum, is obtained from this species and from *G. gummifera* Linn. f. The exudation from both species is apparently identical, and in both cases forms transparent tears from the extremities of the young shoots and buds. These shoots and buds are broken off with the drops of gum-resin attached, and exposed for sale either in this form, or after agglutination into cakes or irregular masses.

Commercial *Dikamali* is sold either in the form of the twigs coated with and agglutinated by the gum-resin, or as irregular earthy-looking masses, of a dull olive-green colour which consist of



Flowers of the Brilliant Gardenia (*Gardenia lucida Roxb.*).



Tree of the Brilliant Gardenia (*Gardenia lucida Roxb.*).

Photos by C. McCann.

the resin more or less mixed with bark, sticks, and other impurities. It has a peculiar and offensive odour like that of cat's urine. When carefully collected and free from impurity it is transparent and of a bright yellow colour. The gum-resin has been found to contain two distinct resins. One of these, an amorphous greenish-yellow substance, is by far the largest constituent; the other occurs only in small proportion, and is obtained in slender, pale, yellow, crystalline needles. To the latter the name of Gardenin has been applied, and from it is derived a very interesting brilliant crimson, crystalline substance called gardenic acid.

Medical Uses: Ainslie in his *Materia Indica* writes: 'Cumbipisin or cumbi-gum is a strong-smelling gum-resin, not unlike myrrh in appearance, and possessing, the Hakims say, nearly similar virtues; it is, however, far more active, and ought, on that account, to be administered in very small doses; as an external application, it is employed, dissolved in spirits, for cleaning foul ulcers, and, where the balsam of Peru cannot be obtained, might be used as a substitute for arresting the progress of sphacelous and phagedenic affections, which that medicine has the power of doing (at least in hot climates) in a very wonderful manner.' The drug is considered anti-spasmodic, carminative, and when applied externally, antiseptic and stimulating. It is accordingly employed by the Natives of Southern and Western India, in cases of hysteria, flatulent dyspepsia, and nervous disorders due to dentition in children, also externally as an application to foul and callous ulcers, and extensively to keep away flies from sores. It has also been employed in European practice for the last purpose with marked success, both in hospitals and in veterinary work, and is said to be a successful anthelmintic in cases of round worm (Watt).

'The gum of the tree melted in oil is applied to the forehead to check headache' (V. Ummegudien, Madras).

Wood: Yellowish white, close-grained, hard, containing no heartwood, weight 39 lbs. per cubic foot. It is useful for turning, and is employed for making combs by the Natives.

Gardening: For sowing it is preferable to separate the numerous seeds, though in nature a whole fruit will rot and the seeds germinate in a heap. The seedlings do best in partial shade (Haines).

(*To be continued*).

REVISION OF THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. Blatter, s.j., ph.d., f.l.s.

Part XXII.

(*Continued from page 537 of volume XXXVI*).

RUBIACEAE

BY

E. Blatter, s.j., ph.d., f.l.s., and C. McCann, f.l.s.

(*With one plate and one photo*).

1. Sarcocephalus Afzel. *ex* R. Br. (Cke. i, 578).

Species 10.—Palaeotropics.

1. **Sarcocephalus missionis** Haviland Rev. Naucl. in Journ. Linn. Soc. xxxiii (1897) 32; Talbot For. Fl. Bomb. Pres. ii, 84; Cke. ii, 578.—*Nauclea missionis* Wall. Cat. 6099; Hook. f. F.B.I. iii (1880) 27; Gamble Fl. Madras 582.—*N. elliptica* Dalz. & Gibs. Bomb. Fl. (1861) 118 (*non* Bedd.).
Distribution: N. Kanara, Madras Presidency: W. coast, in Malabar and Travancore up to 1,500 ft., on river-banks.

2. Anthocephalus A. Rich. (Cke. i, 579).

Species 3.—Indo-Malaya.
A. indicus given by Cooke has to be changed into *A. Cadamba*.

1. **Anthocephalus Cadamba** Miq. Fl. Ind. Bat. ii (1856) 135; Hook. f. F.B.I. iii (1880) 23.—*Nauclea Cadamba* Roxb. Hort. Beng. (1814) 14; Bedd. Fl. Sylv. t. 35.—*Anthocephalus indicus* A. Rich. in Mem. Soc. Hist. Nat. Par. v (1834) 238; Gamble Fl. Madras 583.—*A. morindaefolius* Korth. Verh. Gesch. Bot. (1839-42) 154.
Distribution: Konkan, N. Kanara, throughout India, often cultivated, Burma.—Ceylon, Sumatra, Borneo.

3. Neonauclea Merr.

(*Nauclea ouct.*, *non* Linnaeus (Cke. i, 580).

Nauclea purpurea Roxb. given by Cooke has to be changed into *Neonauclea purpurea* Merr.

1. **Neonauclea purpurea** (Roxb.) Merr. in Interpr. Herb. Amb. (1917) 483; Gamble Fl. Madras 584.—*Nauclea purpurea* Roxb. Corom. Pl. i (1795) 41, t. 54; Hook. f. F.B.I. iii (1880) 26 (*partim*); Cke. i, 580.—*N. elliptica* Bedd. Ic. t. 19 (*non* Dalz. & Gibs.).
Description: Cke. l.c.
Distribution: Bombay Presidency: Konkan, N. Kanara. Madras Presidency: N. Circars, hills of Godavari at 2,000 ft., in moist valleys, Deccan, hills of Coimbatore, W. Ghats, from S. Kanara to Malabar, up to 3,000 ft.

4. Adina Salisb. (Cke. i, 580).

Species 15.—Tropical Asia, Africa.

1. **Adina cordifolia** Hook. f. in Gen. Pl. ii (1873) 30; F.B.I. iii (1880) 24; Brandis For. Fl. t. 33; Cke. i, 581.—*Nauclea cordifolia* Willd.; Roxb. Corom. Pl. t. 53; Bedd. Fl. t. 33.
Locality: *Konkan*: Bombay (Blatter !); Tulsi Lake (McCann !).—*W. Ghats*: Khandala (McCann !).—*Deccan* (*ex* Cooke).

Distribution: Konkan, W. Ghats, Deccan of Bombay Presidency. In the Madras Presidency in all dry deciduous forests in the Circars, Deccan and Carnatic, less common in the W. Ghats. From the Himalayas to Burma and through Central and S. India to Ceylon, Mt. Abu.

Note: See C. E. C. Cox, Note on Haldu (*Adina cord.*). In Ind. For. Dept. For. Bull. 42 (1921) 23 p.

5. MITRAGYNA Korth. (Cke. i, 581).

Species 12.—Tropical Asia, Africa.

1. **Mitragyna parvifolia** Korth. Obs. Naucl. Ind. (1839) 19; Cke. i, 581.—*Stephegyne parvifolia* Korth.—*Nauclea parvifolia* Willd.; Roxb. Hort. Beng. (1814) 14; Corom. Pl. t. 52; Bedd. Fl. Sylv. t. 34.

Locality: Add: *Sind*: Sukkur, forest nursery (Sabnis !).—*Gujarat*: Frequent in Modasa Petha (Sedgwick !).—*Konkan*: All over Salsette (McCann !).—*W. Ghats*: Khandala (Blatter !).

Distribution: Throughout the drier parts of India.—Ceylon.

6. HYMENODICTYON Wall. (Cke. i, 582).

Species 8.—Tropical Africa and Asia.

We retain the 2 species given by Cooke.

1. **Hymenodictyon excelsum** Wall. in Roxb. Fl. Ind. ed. Carey ii (1824) 149; Hook. f. F.B.I. iii (1880) 35 (*vide syn. ibidem*); Cke. i, 582.

Description: Cke. l.c.—The capsule valves persist when the tree is leafless (Gamble).

Locality: Add: *Konkan*: Salsette, above Kanari Caves, common (Blatter & McCann !).—*W. Ghats*: Khandala (McCann !).

Distribution: Along the base of the Punjab Himalaya, W. to the Ravi, ascending to 5,000 ft., from Nepal eastwards to Chittagong and Burma, and southwards to Central and S. India, Mt. Abu.—Java.

2. **Hymenodictyon obovatum** Wall. in Roxb. Fl. Ind. ed. Carey ii (1824) 153; Cke. i, 583.

Description: Cke. l.c.—Flowers greenish or greenish white or white.

Locality: Add: *N. Kanara*: Castle Rock (Blatter !).

7. WENDLANDIA Bartl. (Cke. i, 583).

Species 20.—Indo-Malaya, China.

We retain the 2 species given in Cooke, but change *W. notoniana* Wall. into *W. thyrsoidea* Steud.

1. **Wendlandia exserta** DC. Prodr. 4 (1830) 411; Hook. f. F.B.I. iii (1880) 37; Cke. i, 584.—*Rondeletia exserta* Roxb. Hort. Beng. (1814) 14.

Distribution: Tropical Himalaya, from the Chenab eastwards to Nepal and Sikkim, up to 4,500 ft., Orissa, Central India, Konkan and Deccan of Bombay Presidency, N. Circars of Madras Presidency.

2. **Wendlandia thyrsoidea** Steud. Nom. ed. 2, ii, 786.—*Webera thyrsoidea* Roth. Nov. Sp. (1821) 149.—*Canthium thyrsoideum* Roem. & Schult. Syst. v, 207.—*Wendlandia Notoniana* Wall. Cat. (1828) 6273; Wight & Arn. Prodr. (1834) 403; Wight Ic. t. 1033; Hook. f. F.B.I. iii (1880) 40; Cke. i, 584.

Description: Cke. l.c.—Flowers white or pale yellow, fragrant.

Distribution: Bombay Presidency: Konkan, W. Ghats, S. M. Country, N. Kanara; Madras Presidency: Deccan, hills of Cuddapah, Bellary and Coimbatore, above 3,000 ft., W. Ghats, hills of S. Kanara to the Nilgiris, Pulneys and hills of Travancore, above 5,000 ft., Shevaroy hills.—Ceylon.

8. DENTELLA Forst. (Cke. i, 585).

Species 1.—Indo-Malaya.

1. **Dentella repens** Forst. Char. Gen. (1776) 26, t. 13; Hook. f. F.B.I. iii (1880) 42; Cke. i, 585.

Locality: Add: *Konkan*: Tardeo, Bombay Island (Hallberg !); Salsette (Hallberg !); Pen (Hallberg !).

9. ARGOSTEMMA Wall. (Cke. i, 585).

Species 85.—Asia, Africa.
We retain the 2 species given in Cooke.

1. **Argostemma courtallense** Arn. in Ann. Nat. Hist. iii (1839) 22; Wight Ic. t. 1160; Hook. f. F.B.I. iii (1880) 42; Cke. i, 585.
Distribution: S. M. Country, N. Kanara, W. Ghats of the Madras Presidency up to 3,000 ft., on rocks in shady places.

2. **Argostemma verticillatum** Wall. in Roxb. Fl. Ind. ed. Carey ii (1824) 325; Hook. f. F.B.I. iii (1880) 43; Cke. i, 586.
Distribution: Konkan, Anamalais, temperate Himalaya, from Kumaon to Sikkim, 2,000-6,000 ft., Khasia Mts., 4,000 ft., Burma (not in Malay Peninsula).

10. OLDENLANDIA Plum.

Many botanists now unite *Hedyotis* Linn. and *Oldenlandia* Linn. under *Oldenlandia* Plum. as it is difficult to find characters to keep the two genera separate.

Haines (Bot. Bihar & Orissa p. 144) though admitting that 'some of the herbaceous species are only separable by the more dilated stipules and the wider base of the sepals which characters are only relative and not always evident,' keeps the two genera separate. His only reason for doing so is because both genera are large and because he wants to avoid the multiplication of synonyms.

We unite the two genera, giving first the diagnosis of *Oldenlandia* Plum.

Shrubs, undershrubs or herbs, usually dichotomously branched. Leaves opposite, rarely ternately whorled; stipules interpetiolar, free or connate with the petioles, often pectinately or pinnatifidly fringed. Flowers white or pink, sometimes blue, in axillary or terminal, often paniculate, cymes, rarely solitary. Calyx-teeth 4, rarely 5, persistent. Corolla rotate campanulate or funnel-shaped; lobes 4, rarely 5, valvate. Stamens 4 or 5, in the throat of the corolla-tube, included or exserted. Ovary 2-celled; ovules numerous, on placentas attached to the septum; style filiform; stigmas 2, linear. Fruit a capsule, membranous or chartaceous, dehiscing septicidally, the cells splitting ventrally, or loculicidally in the upper part, or sometimes indehiscent. Seeds usually many, in cavities on the rounded placentas, smooth or angular; testa usually reticulate or pitted; albumen fleshy.

Species 180.—Warm countries.

As to the species of *Oldenlandia* given by Cooke we retain all of them except that we change *O. crystallina* into *O. pumila* and add a new species, *O. Sedgwickii*.

Key after Cooke and Gamble:

A. Capsule indehiscent or late dehiscent or the crown only dehiscing loculicidally
  I. Capsule indehiscent ... ... 1. *O. auricularia.*
  II. Capsule loculicidal on the crown only
    1. Leaves linear-subulate, aristate ... 2. *O. pygmaea.*
    2. Leaves elliptic or linear-lanceolate, acute 3. *O. glabella.*
B. Capsule dehiscent loculicidally in the upper part, sometimes nearly to the base
  I. Corolla-tube short
    1. Peduncles 1-4-flowered from the lower or all the axils
      a. Leaves linear, not exceeding 3 mm. broad; bases of calyx-teeth not touching the fruit
        † Top of capsule flat, not protruded
          § Flowers pedicelled, usually in pairs ... ... 4. *O. corymbosa.*
          §§ Flowers sessile or nearly so, solitary ... ... 5. *O. diffusa.*
        †† Top of capsule rounded, protruded ... ... 6. *O. herbacea.*

b. Leaves elliptic, exceeding 3 mm. broad; base of calyx-teeth touching fruit ... ... 7. *O. pumila.*
2. Peduncles many-flowered, chiefly from the axils
a. Flowers in umbels; pedicels very short ... ... 8. *O. umbellata.*
b. Flowers in axillary clusters, sessile or nearly so; capsule hairy ... 9. *O. trinervia.*
c. Flowers on long capillary pedicels or in slender panicles; capsule minute, glabrous ... ... 10. *O. dichotoma.*
II. Corolla-tube long
1. Leaves whorled
a. Branches scabrid with whitish points; capsule scabrid ... ... 11. *O. aspera.*
b. Branches retrorsely hispid; capsule glabrous ... ... 12. *O. retrorsa.*
2. Leaves opposite, not whorled
a. Corolla-tube 11 mm. long; lobes obtuse; capsule obovoid ... ... 13. *O. gracilis.*
b. Corolla-tube 4 mm. long; lobes acuminate; capsule globose ... 14. *O. senegalensis.*
C. Capsule compressed, as broad as long, opening by transverse slit in crowns; seeds rough 15. *O. Sedgwickii.*

1. **Oldenlandia auricularia** K. Schum. in Engl. & Prantl Nat. Pflanzenf. iv, 4 (1891) 25; Gamble Fl. Madras 597.—*Hedyotis auricularia* Linn. Sp. Pl. (1753) 101; Hook. f. F.B.I. iii (1880) 58; Cke. i, 587.

Distribution: Throughout E. Bengal from Nepal, Sikkim and the Khasia Mts. to Assam. Chittagong, Malay Peninsula, Konkan, S. M. Country, N. Kanara, Circars, Deccan and Carnatic of the Madras Presidency, W. Ghats and W. coast from S. Kanara southwards at low levels.—Ceylon, Malay Archipelago, S. China, Philippines, Australia.

2. **Oldenlandia pygmaea** O. Kze. Rev. Gen. Pl. 292.—*Hedyotis pygmaea* Wall. Cat. 6199.—*Hedyotis coerulea* Wight & Arn. Prodr. (1834) 412; Hook. f. F.B.I. iii (1880) 60; Cke. i, 587.—*Oldenlandia coerulea* Gamble Fl. Madras 597.

[The specific name *coerulea* is preoccupied by *Oldenlandia coerulea* O. Kze. Rev. Gen. Pl. 292.—*Metabolus coeruleus* Bl. Bijdr. (1825) 992.—*Hedyotis vestita* R. Br. in Wall. Cat. (1828) n. 847.]

Description: Cke. l.c.

Distribution: Dharwar, E. coast of Madras Presidency, Ganjam and Tanjore, on coast sands, W. coast, in S. Kanara.

3. **Oldenlandia glabella** O. Kze. Rev. Gen. Pl. (1891) 292.—*Hedyotis glabella* R. Br. in Wall. Cat. (1828) 886; Bedd. Ic. t. 36.—*Hedyotis nitida* Wight & Arn. Prodr. (1834) 412; Hook. f. F.B.I. iii (1880) 61; Cke. i, 587.—*Oldenlandia nitida* Gamble Fl. Madras 597.

Distribution: Dharwar, N. Kanara, hills of the N. Circars, W. Ghats from S. Kanara southwards, Ceylon, Burma.—Java.

4. **Oldenlandia corymbosa** Linn. Sp. Pl. (1753) 119; Hook. f. F.B.I. iii (1880) 64; Cke. i, 588.

Locality: Add: *Gujarat*: Very common in Savannah (Sedgwick !).—*Konkan*: Parel, Bombay Island (Blatter !).—*W. Ghats*: Khandala (Blatter !).

5. **Oldenlandia diffusa** Roxb. Hort. Beng. (1814) 11; Hook. f. F.B.I. iii (1880) 65; Cke. i, 589.

Flowers white.

6. **Oldenlandia herbacea** Roxb. Hort. Beng. (1814) 11; Gamble Fl. Madras 601.—*Hedyotis herbacea* Linn. Sp. Pl. (1753) 102.—*H. Heynii* R. Br. in Wall. Cat. (1828) 867.—*Oldenlandia Heynii* G. Don Gen. Syst. iii (1834) 531.

Locality: Add: *Konkan*: Malvan (Blatter !).—*W. Ghats*: Khandala (Blatter !).

7. **Oldenlandia pumila** (Linn. f.) DC. Prodr. iv, 425.—*Hedyotis pumila* Linn. f. Suppl. (1781) 119.—*O. crystallina* Roxb. Hort. Beng. (1814) 11; Hook. f. F.B.I. iii (1880) 65; Cke. i, 589.

Locality: *Konkan*: Bombay Island (McCann !).—*S.M. Country*: Belgaum (Ritchie 1781).

Distribution: Punjab Plain below Jammu, and in the W. Himalaya near Simla and in Garhwal. Elsewhere in E. Bengal and in the Deccan, Konkan, S. M. Country, Madras to Negapatam, Travancore.—Java.

8. **Oldenlandia umbellata** Linn. Sp. Pl. (1753) 119; Hook. f. F.B.I. iii (1880) 66; Cke. i, 590.

Flowers lilac.

Distribution: Orissa, Bengal, Burma, Deccan of Bombay and Madras Presidency, Circars and Carnatic, in dry places.

9. **Oldenlandia trinervia** Retz. Obs. Bot. fasc. 4 (1786) 23; Hook. f. F.B.I. iii (1880) 66; Cke. i, 590.—*Hedyotis trinervia* Roem. & Schult. Syst. iii (1818) 197.

Distribution: Chittagong, Burma, Konkan, E. and W. coast of Madras Presidency, in damp places, from Madras and S. Kanara southwards.—Ceylon, Malay Peninsula, Malay Islands, tropical Africa.

10. **Oldenlandia dichotoma** Hook. f. F.B.I. iii (1880) 67; Cke. i, 590—*Hedyotis dichotoma* Koen. *ex* Roth Nov. Sp. (1821) 93.

Distribution: Bundelkhand, Deccan, S. M. Country, N. Circars and Deccan of Madras Presidency, in hilly country up to 4,500 ft., usually on rocks.

11. **Oldenlandia aspera** DC. Prodr. iv (1830) 428; Hook. f. F.B.I. iii (1880) 68; Cke. i, 591.—*Hedyotis aspera* Heyne in Roth Nov. Sp. (1821) 94.

Flowers rose-coloured (Ritchie), pale blue (Dalzell), white (Gamble).

Distribution: Punjab, Rohilkhand, W. Rajputana, Deccan, S. M. Country, Deccan of Madras Presidency, on dry stony lands in Cuddapah, Anantapur, Bellary and Coimbatore.—Tropical Africa.

12. **Oldenlandia retrorsa** Boiss. Fl. Or. iii (1875) 12; Hook. f. F.B.I. iii (1880) 68; Cke. i, 591.

Distribution: Sind, Arabia.

13 **Oldenlandia gracilis** Hook. f. F.B.I. iii (1880) 68; Cke. i, 591.—*Hedyotis gracilis* Wall. in Roxb. Fl. Ind. ed. Carey i (1824) 371.

Distribution: Tropical Himalaya, 1,000-5,500 ft., from Garhwal to Sikkim, Burma and plains of N. Bengal, S. M. Country, Deccan in Coimbatore hills at 4,000 ft., Carnatic, in Tinnevelly and S. Travancore, Ava.

14. **Oldenlandia senegalensis** Hiern in Oliver Fl. Trop. Afr. iii (1877) 56; Cke. i, 592.—*O.? senegalensis* Hiern in Hook. f. F.B.I. iii (1880) 68.—*O. nagporensis* Brace in Haines Bot. Bih. & Or. 448.

This is a very doubtful plant. Hook. f. l.c. put it under *O. senegalensis* Hiern with hesitation. In Haines we find the same Chota Nagpur plant (collected by C. B. Clarke at Hazaribagh) under *O. nagpurensis* Brace. We have not seen Woodrow's specimen gathered at Poona. Cooke says that the material is still insufficient for accurate determination.

15. **Oldenlandia Sedgwickii** Blatter in Journ. & Proc. Asiat. Soc. Bengal, new series, xxvi (1930) 344.

Locality: *N. Kanara*: Karwar, in wet place in evergreen above the sea (Sedgwick 6653 ! type).

11. ANOTIS DC. (Cke. i, 592).

Species 25.—Indo-Malaya, 1 S. America.

We retain the first 7 species given by Cooke, but exclude *A. Ritchiei* as there is no evidence that Ritchie gathered the plant within the limits of the Presidency.

1. **Anotis Leschenaultiana** Benth. & Hook. f. Gen. Pl. ii (1873) 59, & Hook. f. F.B.I. iii (1880) 72.—*Hedyotis Leschenaultiana* Wight & Arn. Prodr. 411; Wight Ill. t. 125.

Flowers red-purple (Cooke), pink or blue-purple (Gamble).

Distribution: S. M. Country, W. Ghats of Madras Presidency, 4,000-7,000 ft., usually in wet places.

2. **Anotis lancifolia** Hook. f. in F.B.I. iii (1880) 73; Cke. i, 593.
Locality: Add: *W. Ghats*: Forming pure formations on Tableland of Panchgani and other places; likes a variety of habitats: rocks, gravel, meadows, pools, dry slopes.
Flowers: Aug. (Panchgani).

3. **Anotis Rheedei** Benth. & Hook. f. Gen. Pl. ii (1873) 59; Hook. f. F.B.I. iii (1880) 73; Cke. i, 593.
Distribution: Konkan, W. Ghats, W. coast and W. Ghats of Madras Presidency, hills of S. Kanara and Mysore to Cochin and Anamalais.

4. **Anotis carnosa** Benth. & Hook. f. Gen. Pl. ii (1873) 59, Hook. f. F.B.I. iii (1880) 74; Cke. i, 594.
Distribution: Konkan, N. Kanara, seashore of S. Kanara.

5. **Anotis quadrilocularis** Hook. f. F.B.I. iii (1880) 74; Cke. i, 594.
Distribution: S. M. Country, Bababudan hills of Mysore at 6,000 ft., hills of Travancore and Tinnevelly, rare in Nilgiris.

6. **Anotis Montholoni** Hook. f. F.B.I. iii (1880) 73; Cke. i, 595.
Distribution: Deccan, S. M. Country, N. Kanara, W. Ghats from Mysore and S. Kanara to Malabar.

7. **Anotis foetida** Benth. & Hook. f. Gen. Pl. ii (1873) 59, & Hook. f. F.B.I. iii (1880) 74; Cke. i, 595.
Distribution: Konkan, W. Ghats, S. M. Country, N. and S. Kanara.

12. OPHIORRHIZA Linn. (Cke. i, 596).

Species 80.—Indo-Malaya.
Ophiorrhiza Harrisiana Heyne in Cke. will be called *O. prostrata* D. Don.

1. **Ophiorrhiza prostrata** D. Don Prodr. Fl. Nep. (1825) 136.—*O. Harrisiana* Heyne in Wall. Cat. (1828) 6236; Cke. i, 596.
Flowers white or pinkish.
Locality: Add: *N. Kanara*: Castle Rock (McCann !).

13. MUSSAENDA Linn. (Cke. i, 596).

Species 60.—Palaeotropics.
Cooke has only 1 species: *M. frondosa* Linn. which has been split up by Gamble into several species. Our Bombay species must be called *M. glabrata* Hutch.

1. **Mussaenda glabrata** Hutch. in Gamble Fl. Madras 610.—*M. frondosa var. glabrata* Hook. f. F.B.I. iii (1880) 90.
Locality: Add: *Konkan*: Salsette hills (McCann !).—*W. Ghats*: Mahableshwar (McCann !).

14. CHOMELIA Linn. (*non* Jacq.).

(*Tarenna* Gaertn.) (Cke. i, 597).

Species 30.—Tropical Asia, Africa.

1. **Chomelia asiatica** O. Kze. Rev. Gen. Pl. 278.—*Rondeletia asiatica* Linn. Sp. Pl. (1753) 172.—*Tarenna zeylanica* Gaertn. Fruct. i (1788) 139, t. 28, f. 3; Cke. i, 598.—*Webera corymbosa* Willd. Sp. Pl. i (1797) 1224; Hook. f. F.B.I. iii (1880) 102.
Distribution: Konkan, N. Kanara; Madras Presidency: dry forests in all plains districts, common, W. Ghats, Shola forests of the Bababudan hills, Nilgiris, Anamalais, Pulneys, and Tinnevelly hills at or over 5,500 ft.

15. RANDIA Houst. *ex* Linn. (Cke. i, 598).

Species 125.—Tropics.
To the 4 species given by Cooke we add *R. Brandisii* Gamble.

Key after Gamble:

A. Armed
I. Berry with seeds embedded in pulp
1. Spines short, sharp, in 1-2 pairs at the ends of arrested branchlets; leaves large, obovate or oblanceolate, obtuse or sometimes acute when young, up to 20 cm. long by 10 cm. broad. Flowers solitary, dimorphic, in larger flowers up to 5 cm. diam., fruit ovoid, smooth, up to 7.5 cm. long; seeds smooth ... 1. *R. uliginosa.*
2. Spines axillary, opposite or alternate; flowers single or in fascicles of 1-3; corolla under 2.5 cm. diam.
a. Leaves obovate, under 4 cm. long, 18 mm. broad; calyx-lobes about 5 mm. long, ovate with occasional intermediate appendages; fruit globose or slightly ribbed, about 20 mm. diam.; seeds smooth ... 2. *R. dumetorum.*
b. Leaves usually more than 4 cm. long. Calyx-lobes ovate, often with subulate appendages like the tube, densely hairy, 5 mm. long; leaves elliptic or obovate with prominent regular hispidly villous nerves, which have tufts in their axils, up to 7.5 cm. long, 4 cm. broad; fruit ovoid-globose, ribbed, 2.5-4 cm. diam.; seeds smooth and usually minutely reticulate ... ... 3. *R. Brandisii.*
II. Berry with seeds not embedded in pulp ... 4. *R. malabarica.*
B. Unarmed; a climbing shrub ... ... 5. *R. rugulosa.*

1. **Randia uliginosa** DC. Prodr. iv (1830) 386; Hook. f. F.B.I. iii (1880) 110; Cke. i, 599.—*Gardenia uliginosa* Retz. Obs. ii (1781) 14; Roxb. Corom. Pl. t. 135.

Locality: Add: *Konkan*: Vehar Lake (Blatter !); E. bank of Vehar Lake (McCann !); Borivli (McCann !); Kanari Caves (McCann !); Keltan, Thana Dist. (Ryan 722 !); Wada (Ryan 600 !).—*S.M. Country*: Londa (Dr. Burns !).—*N. Kanara*: Castle Rock (Herb. Econ. Bot. Poona !).

Distribution: Bihar, Bengal, U. Provinces, Central India, Gujarat, Konkan, S. M. Country, N. Kanara, all dry districts of Madras Presidency in open forests, in wet places, savannah lands and on black cotton soil, in the hills up to 3,000 ft., Ceylon, Burma.

2. **Randia dumetorum** Lam. Tab. Encycl. ii (1793) 227; Hook. f. F.B.I. iii (1880) 110 (*partim*); Cke. i, 599 (*partim*); Wight Ic. t. 580.—*Gardenia dumetorum* Retz. Obs. ii (1781) 14.

Gamble Fl. Madras 615, has separated from Hook. f.'s synonymy: *R. longispina* Wight & Arn. Prodr. 398.

See also Kew Bull. (1921) 312, 313.

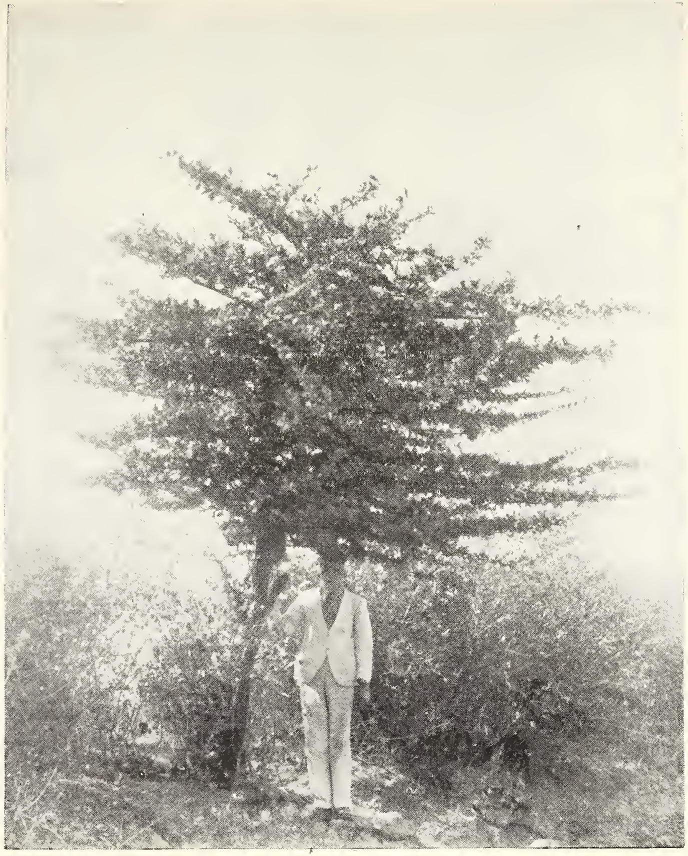
For descriptive details of *R. dumetorum* see key.

We have not been able to examine specimens from all the localities mentioned by Cooke, and are, therefore, not sure whether they refer to the true *R. dumetorum*, to *R. longispina* or to the following species, *R. Brandisii.*

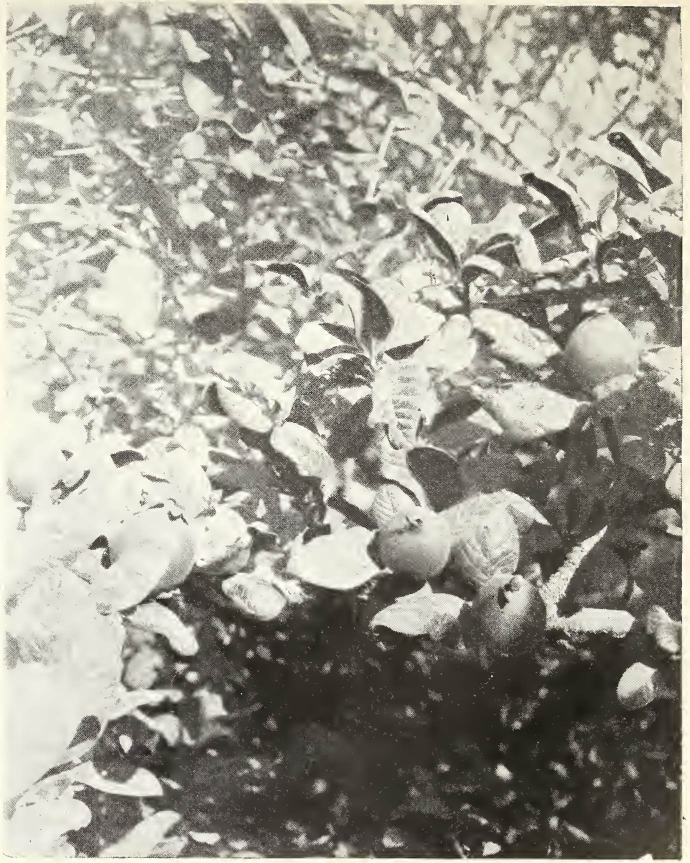
3. **Randia Brandisii** Gamble Fl. Madras 616.—*R. tomentosa* Wight & Arn. Prodr. 398 (*non* Blume).

For characteristic details see key.—The fruits when green are short-pubescent. When the fruit is handled the pubescence comes off very easily. Young branches heavily armed with long spines up to 5 cm. long and very pubescent (including the spines).

Brandis, Indian Trees 382 under *R. dumetorum*, mentions: 'A remarkable form, possibly a distinct species, with leaves densely velvety beneath, hairy



Tree of *Randia Brandisi* Gamble.



Fruit of *Randia Brandisi* Gamble.
Photos by C. McCann

above, sec. n. prominent, 10-12 pair, fr. ribbed and crowned with the semi-persistent calyx-lobes.' He found this plant on the Satara Ghats and at Mahableshwar.

Locality: *W. Ghats*: Khandala (Bhiva !); Lonavla (Herb. Cooke !); Sakarpathar (Gammie 15174 !); Mahableshwar (Cooke !); Lingmala (McCann !); Panchgani (McCann !).—*Deccan*: Between Karli and Lonavla (Bhiva !); Karli (Gammie 15135 !); Lohagad (Gammie 16202 !).—*S.M. Country*: Sulgutte (Talbot 3813 !); Sulebhavi, near Belgaum (Herb. Econ. Bot. Poona !); Dharwar (Talbot !).—*N. Kanara*: Mundgod (Talbot 371 !); Tinai Ghat (Gammie 15798 !).

Distribution: W. Ghats of Bombay Presidency, Western Deccan and Carnatic from Mysore and Bellary to S. Travancore; W. Ghats, dry slopes of Nilgiris and Pulneys up to 4,000 ft.

The following remark by Gamble (Kew Bull. 1912, 314) should induce botanists to search for the true facts regarding the distribution of *R. dumetorum*: 'I have come to the conclusion that almost the whole of the material in the Kew and other Herbaria from the W. Ghats and Coasts belongs to this species, which is quite distinct from *R. dumetorum*, Lamk.'

4. **Randia malabarica** Lam. Encycl. Méth. iii (1789) 25; Hook. f. F.B.I. iii (1880) 111; Cke. i, 600; Talbot For. Fl. Bomb. ii (1911) 99.

Locality: *N. Kanara*: Belekerry (Talbot 4481 !).

Distribution: N. Kanara, N. Circars, Deccan and Carnatic, to S. Travancore and the E. slopes of the W. Ghats in dry evergreen forests, common.

5. **Randia rugulosa** Hook. f. in F.B.I. iii (1880) 113; Cke. i, 600.

Locality: *W. Ghats*: Lonavla (Bhide !, Gammie !); Mahableshwar (Cooke !); Matheran, near reservoir (Cooke !); Manoli forest, Ambu Ghat (Shevade !).—*S.M. Country*: Belgaum to Vengurla Rd. (Bhide !).—*N. Kanara*: Tinai Ghat side, Castle Rock (P.S.K. 190 !); Tinai Ghat (Talbot 1364 !); Devimane (Talbot 4403 !); Sampkhand (Herb. Talbot !); Malamani (Talbot 3743 !).

Distribution: Konkan, S. M. Country, N. Kanara, W. Ghats, from S. Kanara and Coorg to the Nilgiris, Anamalais, Pulneys and the hills of Tinnevelly and Travancore, up to 4,000 ft.

16. GARDENIA Ellis (Cke. i, 601).

Species 80.—Palaeotropics.

The 4 indigenous species given by Cooke are retained, also a cultivated species.

1. **Gardenia turgida** Roxb. Hort. Beng. (1814) 15.—*G. montana* Roxb. Fl. Ind. i (1832) 709; Wight Ic. t. 577.—*G. turgida var. montana* Hook. f. F.B.I. iii (1880) 118; Cke. i, 601.

Distribution: Base of Himalaya from Garhwal to Bhutan, Bihar, Chota Nagpur, Central India, Deccan of Bombay Presidency, S. M. Country. N. Kanara, all dry deciduous forests of the Madras Presidency, especially on rocky hills and on laterite and kunkar.

2. **Gardenia lucida** Roxb. Hort. Beng. (1814) 15; Wight Ic. t. 575; Hook. f. F.B.I. iii (1880) 115; Cke. i, 602.

Locality: Add: *Konkan*: Kanari Caves, hills of Kandivli (McCann !).—*W. Ghats*: Khandala (McCann !).

Distribution: Burma, Chittagong, Konkan and W. Ghats of Bombay, S.M. Country, N. Kanara, Deccan and Carnatic of Madras Presidency, in deciduous forests in all dry districts.

3. **Gardenia latifolia** Ait. Hort. Kew. i (1789) 294; Roxb. Corom. Pl. t. 134; Wight Ic. t. 759; Hook. f. F.B.I. iii (1880) 116; Cke. i, 602.—*G. enneandra* Koen. in Roxb. Fl. Ind. ed. Carey ii (1824) 552; Wight Ic. t. 574.

Distribution: From the N.-W. Himalaya, in Garhwal only, ascending to 3,000 ft., southwards to Bihar and W. Bengal, Central Provinces, S. M. Country, N. Kanara, N. Circars and Deccan of Madras Presidency, extending to the lower hills of the Ghats, in dry deciduous forests.

4. **Gardenia gummifera** Linn. f. Suppl. (1781) 164; Hook. f. F.B.I. iii (1880) 116; Cke. i, 603.

Distribution: Bundelkhand, southwards from Chota Nagpur, S. M. Country, N. and S. Kanara, N. Circars, Deccan and Carnatic in deciduous forests, in dry hot localities, westwards to the foot of the Ghats, on the Malabar coast only in dry laterite forest.

*5. **Gardenia jasminoides** Ellis in Phil. Trans. 51 (1761) pt. ii, 935.—*G. florida* Linn. Sp. Pl. ed. 2 (1762) 305.—*Warneria augusta* Linn. in Amoen. Acad. iv (1799) 138 *sine descr.* Skeels in U.S. Dept. Agr. Bur. Pl. Ind. Bull. 242 (1912) 14.

Description: A glabrous, unarmed shrub usually about 1 m. high. Leaves elliptic-ovate, narrowed at both ends, usually acute, shining, short-petioled, 2-6 cm. long. Flowers large, very fragrant, solitary in the upper axils. Calyx green, the tube funnel-shaped, about 1.5 cm. long, 5-angled or winged, the lobes linear, about as long as the tube. Corolla usually double, white, soon turning yellowish, about 5 cm. long, 5-7 cm. wide.

Distribution: A native of China and Japan. Grown in Indian gardens. According to Parker 'apt to be mistaken for *Tabernaemontana coronaria* from the double-flowered variety of which it may be distinguished by its stipules and the absence of latex.'

17. TRICALYSIA A. Rich.

(*Diplospora* DC.; Cke. i, 604).

Evergreen trees or shrubs, branchlets tetragonous or terete. Leaves petioled; stipules interpetiolar, triangular, acuminate, connate at base. Flowers small or very small, polygamo-dioecious, in axillary fascicles or short cymes; bracts and bracteoles connate. Calyx-tube short, obconic or hemispheric; limb truncate, 4-5-lobed. Corolla-tube short; lobes 4-5, twisted to the left in bud, various in size. Stamens as many as the corolla lobes; filaments long or short or even 0; anthers oblong or linear, often curved. Ovary 2-, rarely 3-celled; ovules 2-5 in each cell, on fleshy placentas attached to the septum; style short or long; stigmatic arms linear or oblong. Fruit a globose or ovoid berry, the pericarp thick, cells 2. Seeds few in each cell, compressed vertically; albumen thin, fleshy; cotyledons ovate, radicle long.

Species 50.—Tropical Africa, Asia.

Cooke has 2 species under *Diplospora*. Both are being transferred without change of specific name to *Tricalysia*.

1. **Tricalysia apiocarpa** Gamble Fl. Madras 620.—*Diplosporia apiocarpa* Hook. f. F.B.I. iii (1880) 123; Bedd. Fl. Sylv. t. 223; Cke. i, 604.—*Discospermum apiocarpum* Dalz. in Kew Journ. Bot. ii (1850) 257; Bedd. Ic. t. 40.

Distribution: Konkan, N. Kanara, W. Ghats of the Madras Presidency, in the Coimbatore hills, Nilgiris, Anamalais and hills of Travancore at 3,000-4,000 ft.

2. **Tricalysia sphaerocarpa** Gamble Fl. Madras 620.—*Diplospora sphaerocarpa* Hook. f. F.B.I. iii (1880) 123; Cke. i, 604.—*Discospermum sphaerocarpum* Dalz. in Kew Journ. Bot. ii (1850) 257.

Distribution: Konkan, Bombay Ghats, Madras Ghats, Courtallum in Tinnevelly.

18. KNOXIA Linn.

Species 9.—Indo-Malaya.

Cooke has 1 species, *K. corymbosa*, we substitute the older name *K. sumatrensis*.

1. **Knoxia sumatrensis** Wall. Cat. 6183.—*Spermacoce sumatrensis* Retz. Obs. iv (1786) 23.—*K. corymbosa* Willd. Sp. Pl. i (1797) 582; Hook. f. F.B.I. iii (1880) 128; Cke. i, 605.

Distribution: Throughout tropical India, from Garhwal eastwards to Sikkim up to 5,000 ft. and in the Khasia Mts. up to 4,000 ft., to the Konkan, S. M. Country, N. Kanara, all forest districts of the Madras Presidency, chiefly on grass-lands in woodland and up to about 6,000 ft. in the hills.—Malay Peninsula, Malay Archipelago, China, Australia.

19. CANTHIUM Lam. (Cke. i, 605 under *Plectronia*).

For this genus see A. A. Bullock, *Canthium* in British East Africa in Kew Bull. (1932) 253 etc.

Shrubs or trees, armed or unarmed, often scandent, with terete or square branchlets. Leaves opposite, chartaceous or coriaceous, shortly petiolate. Stipules interpetiolar, triangular, acuminate or long-cuspidate, or ovate-lanceolate and acute, persistent or often early deciduous. Flowers axillary in pedunculate corymbose cymes, often modified, or in sessile fascicles, or rarely solitary, white, cream or greenish. Calyx: tube (i.e. the portion adnate to the inferior ovary) short, obconic, turbinate, hemispherical or globose; limb very short, cupular or annular, truncate or 4-5-dentate, usually persistent. Corolla: tube short, cylindrical or broadly funnel-shaped, villous at the throat, glabrous outside; limb 4-5-lobed, lobes valvate, erect, spreading or reflexed, as long as or longer than the tube, rarely shorter, oblong or triangular, acute or subacute, glabrous outside or sometimes strigose-pilose towards the apex. Stamens 4-5, inserted at or just below the throat of the corolla; filaments very short, filiform, or almost obsolete; anthers dorso-basifixed, oblong, obtuse or very obscurely mucronate. Disk annular, fleshy. Ovary invariably 2-locular; style usually exserted, or sometimes scarcely as long as the corolla-tube, often more than twice as long as the corolla-tube; stigma capitate, mitriform or subglobose, truncate at the base and apex, or somewhat deeply bilobed, often sulcate. Ovules solitary, anatropous, pendulous. Drupes didymous or by abortion 1-celled; cells globose or ellipsoid. Fruits small or rarely attaining 3 cm. or more in diam., woody or fleshy.

Key:

I. Branches without spines ... ... 1. *C. didymum.*
II. Branches with spines
  1. Flowers 5-merous ... ... 2. *C. Leschenaultii.*
  2. Flowers 4-merous ... ... 3. *C. parviflorum.*

1. **Canthium didymum** Gaertn. f. Fr. iii (1805) 94, t. 196; Bedd. Fl. Sylv. t. 221.—*Plectronia didyma* Kurz For. Fl. ii (1877) 35; Gamble Fl. Madras 624.—*Canthium umbellatum* Wight Ic. t. 1034; Hook. f. F.B.I. iii (1880) 132.—*Plectronia Wightii* T. Cooke Fl. Bomb. i, 606.

2. **Canthium Leschenaultii** Wight & Arn. Prodr. 426; Wight Ic. 826.—*Dondisia Leschenaultii* DC. Prodr. iv (1830) 469.—*Canthium Rheedii* DC. Prodr. iv (1830) 474; Hook. f. F.B.I. iii (1880) 134.—*Plectronia Rheedii* Bedd. For. Man. in Fl. Sylv. (1874) cxxx—5; Cke. i, 606.—*Canthium angustifolium* Roxb. Fl. Ind. i (1832) 533; DC. Prodr. iv (1830) 474; Hook. f. F.B.I. iii (1880) 135.—*Plectronia angustifolia* Benth. & Hook. f. *ex* Kurz in Journ. As. Soc. Beng. xlvi (1877) 154; Kurz For. Fl. ii (1877) 37.

Description: Cke. i, 606.

Distribution: Sundribuns, Sylhet, Chittagong, Konkan, S. M. Country, N. Kanara, W. Ghats and W. coast from S. Kanara southwards up to 5,000 ft. Ceylon.

3. **Canthium parviflorum** Lam. Encycl. Méth. i (1785) 602; Hook. f. F.B.I. iii (1880) 136; Roxb. Corom. Pl. t. 51.—*Plectronia parviflora* Bedd. For. Man. in Fl. Sylv. (1874) cxxxiv—5; Gamble Fl. Madras 625; Cke. i, 607.

Distribution: Deccan of Bombay Presidency, S. M. Country, N. Kanara, all dry plains districts of the Madras Presidency, in scrub forest, especially on laterite and near the coast, very common.

20. VANGUERIA Juss. (Cke. i, 607).

Species 40.—Tropical Africa, Madagascar, Asia.

We retain the 1 species given by Cooke.

1. **Vangueria spinosa** Roxb. Hort. Beng. (1814) 15; Hook. f. F.B.I. iii (1880) 156; Cke. i, 607.

Locality: Add: *Konkan*: Kanari Caves (Blatter !).—*W. Ghats*: Khandala (Blatter !).

Distribution: N. Bengal, Konkan, Deccan, W. Ghats, S. M. Country, N. Kanara, most plains districts of Madras Presidency, Burma, Pegu.—Java.

21. IXORA Linn.

Species 200.—Tropics.

Cooke has 7 species. We retain them all, but change *I. polyantha* into *I. corymbosa* and *I. nigricans* into *affinis*. *I. nigricans* Br. *var. arguta* Hook. f. we restitute to the rank of a species, *I. arguta* Br.

Key:

A. Calyx-teeth longer than the ovary
I. Calyx 6 mm. long; corolla-tube reaching 18 mm. ... ... 1. *I. lanceolaria.*
II. Calyx 12 mm. long; corolla-tube reaching 36 mm. ... ... 2. *I. corymbosa.*
B. Calyx-teeth as long or shorter than the ovary
I. Leaves drying black
1. Stipules shortly triangular at base, cuspidate with a long stiff bristle ... 3. *I. affinis.*
2. Stipules linear-lanceolate acuminate ... 4. *I. arguta.*
II. Leaves not drying black
1. Peduncles 10-18 cm. long ... ... 5. *I. elongata.*
2. Peduncles less than 8 cm. long
a. Flowers white. Small trees
† Corolla-tube less than 6 mm. long, flower-buds globose ... ... 6. *I. brachiata.*
†† Corolla-tube exceeding 6 mm., flower-buds ellipsoid ... ... 7. *I parviflora.*
b. Flowers bright scarlet, a shrub ... 8. *I. coccinea.*

1. **Ixora lanceolaria** Colebr. in Roxb. Fl. Ind. ed. Carey i (1820) 397; Wight Ic. t. 827; Hook. f. F.B.I. iii (1880) 138; Cke. i, 608.
Distribution: Southern districts of the Bombay Presidency, hills of Tinnevelly and Travancore, in evergreen forests.

2. **Ixora corymbosa** Heyne in Wall. Cat. (1828) 6155.—*I. polyantha* Wight Ic. t. 1066; Hook. f. F.B.I. iii (1880) 140; Cke. i, 609.
Distribution: Konkan, N. Kanara, coast in S. Kanara, Malabar and Travancore.

3. **Ixora affinis** Wall. Cat. (1828) 6144.—*I. nigricans* Br. in Wall. Cat. (1828) 6154; Wight Ic. t. 318; Hook. f. F.B.I. iii (1880) 148; Cke. i, 609.
Locality: Add: *Konkan*: Bombay Island (Blatter !).
Distribution: Konkan, W. Ghats, N. Kanara, W. Ghats of Madras Presidency, in evergreen forests, up to about 5,000 ft., common.

4. **Ixora arguta** Br. in Wall. Cat. (1828) 6157; Ridley Fl. Malay Penins. ii, 92.—*I. nigricans var. arguta* Hook. f. F.B.I. iii (1880) 149; Cke. i, 610.
Description: A bush, glabrous, with thin branches. Leaves thin coriaceous (drying black) broad oblanceolate to obovate abruptly short acuminate, base much narrowed; nerves 6-7 pairs; 9-15 cm. long, 3.8-5.7 cm. wide; petioles 5-10 mm. long. Stipules linear-lanceolate acuminate. Corymbs lax on peduncles short or up to 5 cm. long, 5-7.5 cm. across, often many-flowered. Calyx less than 2.5 mm. long, campanulate narrow, teeth narrow lanceolate acuminate acute, as long as tube. Corolla white, tube slender, 7.5-13 mm. long, lobes narrow, acute oblong. Style exsert. Fruit globose, pea-like.
Distribution: S. M. Country, Burma, Malay Peninsula, Malaya.

5. **Ixora elongata** Heyne in Wall. Cat. (1828) 6131; Hook. f. F.B.I. iii (1880) 141; Cke. i, 610.
Distribution: Konkan, Deccan, S. M. Country, N. Kanara, W. Ghats from S. Kanara to the Wynaad and Atapadi hills of Malabar at about 2,000 ft.

6. **Ixora brachiata** Roxb. Hort. Beng. (1814) 10; Wight Ic. t. 710; Hook. f. F.B.I. iii (1880) 142; Cke. i, 610.
Distribution: Konkan, W. Ghats, N. Kanara, W. Ghats from S. Kanara to Travancore at low elevations.

7. **Ixora parviflora** Vahl Symb. iii (1794) 11, t. 52; Wight Ic. t. 711; Hook. f. F.B.I. iii (1880) 142; Cke. i, 611.

8. **Ixora coccinea** Linn. Sp. Pl. (1753) 110; Cke. i, 611.
Flowers bright scarlet, sometimes yellow or pink.

22. Pavetta Linn. (Cke. i, 612).

Species 90.—Palaeotropics.
We retain the 2 species given by Cooke, adding a new variety to *P. indica* Linn.

1. **Pavetta indica** Linn. Sp. Pl. (1753) 110.
Locality: Add: *W. Ghats*: Panchgani, Pasarni Ghat, between Panchgani and Mahableshwar, very common (Blatter !).

Pavetta indica L. in full bloom.

a. **Var. glabra** *var. nov.* Blatter & Hallberg.—*Pedicelli glabri.*
Locality: *Konkan*: Pen (Blatter & Hallberg).

b. **Var. tomentosa** Hook. f.
Locality: On laterite near the seacoast, also in the dry deciduous forests of the Dharwar district and elsewhere throughout the Presidency (Talbot).

2. **Pavetta hispidula** Wight & Arn. Prodr. (1834) 431, **var. siphonantha** Hook. f. F.B.I. iii (1880) 151.
Flowers white or yellowish.
Locality: Add: *W. Ghats*: Khandala (Hallberg !).

23. Morinda Linn. (Cke. i, 613).

Species 45.—Tropics.
We retain the 2 species given by Cooke, omit *var. elliptica* Hook. f. (of *M. citrifolia*) and raise *var. bracteata* Hook. f. to the rank of a species.

Key :

I. Leaves 12-20 cm. long, glabrous, shining
  1. Flowers without bracteoles ... ... 1. *M. citrifolia.*
  2. Flowers subtended by 1-1.5 cm. long, leaf-like bracteoles persisting in fruit ... 2. *M. bracteata.*
II. Leaves 10-15 cm. long, tomentose, dull, not shining ... ... 3. *M. tinctoria var. tomentosa.*

1. **Morinda citrifolia** Linn. Sp. Pl. (1753) 176; Hook. f. F.B.I. iii (1880) 155; Cke. i, 613 (*partim*).

An introduction in the Presidency.

2. **Morinda bracteata** Roxb. Hort. Beng. (1814) 15 (*nomen nudum*); Fl. Ind. ii (1824) 198. i (1832) 544; Ham. in Trans. Linn. Soc. xiii, 534; DC. Prodr. iv, 447; Wight Ic. t. 126; Dalz. & Gibs. Bomb. Fl. (1861) 114; Brandis For. Fl. 278; Merrill Fl. Manila (1912) 453; An Interpr. of Rumph. Herb. Amboi. (1917) 490.—*Morinda citrifolia var. bracteata* Hook. f. F.B.I. iii (1880) 156; Cke. i, 614.

Regarding the variety *bracteata* Cooke (l.c.) says: 'This ought perhaps to take rank as a separate species. It is certainly indigenous along the coast, while *M. citrifolia* is an introduction.' It has been found wild from Malvan to Marmagao along the coast.

Hook. f. (l.c.) united *M. citrifolia* and *bracteata* though, according to his own words, 'Roxburgh who alone seems to have studied these Morindas keeps them apart.' And he adds that Roxburgh 'gives us other distinctive characters' of *bracteata* than the foliaceous calyx-lobes and included anthers. (See Roxburgh's description l.c.).

3. **Morinda tinctoria** Roxb. Hort. Beng. (1814) 15, **var. tomentosa** Hook. f. F.B.I. iii (1880) 156.—*Morinda tomentosa* Heyne in Roth Nov. Pl. Sp. (1821) 147.

Distribution: Deccan, S.M. Country, N. Circars, Central Provinces, Bengal.

24. PSYCHOTRIA Linn. (Cke. i, 615).

Species 400.—Tropics.

Cooke has 6 species. We retain them all.

We add a few notes about the distribution of some species.

3. **Psychotria Dalzellii** Hook. f.—Not endemic in the Bombay Presidency. Occurs also on the W. coast in S. Kanara, Malabar and Cochin.

4. **Psychotria flavida** Talbot.—Not endemic in the Bombay Presidency. Also found in the W. Ghats and on the W. coast from S. Kanara to Travancore.

6. **Psychotria octosulcata** Talbot.—Not endemic in the Bombay Presidency. Occurs also in the W. Ghats of the Madras Presidency.

25. CHASALIA Commers. *ex* DC. (Cke. i, 618).

Species 15.—Palaeotropics.

Cooke has 1 species which we retain.—In 1894 Talbot described a new species *Ch. virgata* (see List of Trees etc. p. 114), but it has been omitted in his For. Fl. of the Bombay Presidency.

26. SAPROSMA Blume (Cke. i, 619).

Species 20.—Indo-Malaya.

We retain the 1 species given by Cooke, but change the name *Sap. indicum* into *S. glomeratum*.

1. **Saprosma glomeratum** Bedd. For. Man. Bot. 134/11.—*Dysodidendron glomeratum* Gardn. in Calc. Journ. Nat. Hist. vii (1847) 3.—*Serissa glomerata* Bedd. in Madr. Journ. Sc. ser. iii, i (1864) 50.—*Saprosma indicum* Dalz. in Kew Journ. Bot. iii (1851) 37; Cke. i, 619.

Distribution: Bombay Presidency: W. Ghats, S. M. Country, N. Kanara, Madras Presidency: W. Ghats, from S. Kanara to Travancore, 2,000-4,000 ft. in evergreen forests.

27. GEOPHILA D. Don.

Species 15.—Tropics.

1. **Geophila reniformis** D. Don Prodr. Fl. Nep. (1825) 136.
Distribution: Sylhet, Khasia hills, Tenasserim, Andamans, Konkan, W. Ghats of Madras Presidency, in moist districts, about 2,000-5,000 ft., not common, Ceylon.

28. LASIANTHUS Jack. (Cke. i, 620).

Species 90.—Indo-Malaya.
Of the 2 species given by Cooke we retain *L. sessilis* and drop *L. venulosus*, because we have not seen any authentic specimen.

1. **Lasianthus sessilis** Talbot Trees & Shrubs Bomb. ed. i (1894) 114; For. Fl. Bomb. Pres. ii, 131, fig. 363.
Locality: *N. Kanara*: Rain forests from Yellapur southwards to Gersoppa, common and often gregarious in the undergrowth in some of the kans (Talbot).

29. HAMILTONIA Roxb. (Cke. i, 621).

Species 4.—Indo-Malaya, China.
We retain the only species given by Cooke.

1. **Hamiltonia suaveolens** Roxb. Hort. Beng. (1814) 15.
Locality: Add: *Konkan*: Kanari caves (Blatter !).—*W. Ghats*: Panchgani (Blatter !).
Distribution: Tropical and subtropical Himalayas, Central India, Konkan, Deccan, W. Ghats, N. Kanara, N. Circars and Deccan, in dry forests, south to Mysore, up to 4,500 ft.—China.

30. HYDROPHYLAX Linn. f. (Cke. i, 622).

Species 3.—Coast of Indian Ocean.

1. **Hydrophylax maritima** Linn. f. Suppl. (1781) 126; Roxb. Corom. Pl. t. 233; Wight Ic. t. 760.
Distribution: Sandy seashores of the Orissa coast, Kathiawar, Konkan, E. and W. coasts of Madras Presidency, on sand dunes, Ceylon; a sand-binding plant.

31. BORRERIA G. F. W. Mey. (Cke. i, 623 under *Spermacoce*).

Annual or perennial herbs, the branches usually 4-gonous. Leaves opposite, sessile or petioled; stipules connate with the petioles in a broad truncate tube with marginal bristles. Flowers very small, in axillary or terminal fascicles; bracteoles many, of soft filiform bristles. Calyx-tube obovoid or turbinate; lobes 2-4, often with intermediate teeth or bristles. Corolla funnel-shaped or hypocrateriform; lobes 4, valvate. Stamens 4, on the throat or tube of the corolla; anthers linear or oblong. Ovary 2-celled; ovules solitary in each cell on septal placentas; style filiform with 2 short arms or stigma capitate. Fruit of 2 coriaceous or crustaceous mericarps which dehisce ventrally, the membranous septum sometimes remaining. Seed oblong, ventrally grooved; testa thin; albumen horny or fleshy; cotyledons small, foliaceous; radicle terete, inferior.
Species 95.—Tropics.
We retain the 2 species given by Cooke, but put them under *Borreria*.

1. **Borreria stricta** K. Schum. in Engl. & Prantl Nat. Pflanzenf. iv, 4 (1891) 143; Gamble Fl. Madras 654.—*Spermacoce stricta* Linn. f. Suppl. (1781) 120; Cke. i, 623.—*Bigelovia stricta* Blume Bijdr. 945.—*B. lasiocarpa et roxburghiana* Wight & Arn. Prodr. 437.
Distribution: Throughout India (Rajputana Desert, Konkan, Deccan, S.M. Country, all districts of Madras Presidency, and up to 5,000 ft. in the hills, usually in forest undergrowth, common, Ceylon).—tropical Asia and Africa.

2. **Borreria hispida** K. Schum. in Engl. & Prantl Nat. Pflanzenf. iv, 4 (1891) 144; Gamble Fl. Madras 654.—*Spermacoce hispida* Linn. Sp. Pl. (1753) 102; Cke. i, 624.—*S. articularis* Linn. f. Suppl. 119; Roxb. Fl. Ind. i (1832) 373.—*S. scabra* Willd. Sp. Pl. i, 572; Roxb. l.c. 371.

Locality: Add: *W. Ghats*: Khandala (Blatter !).—*S. M. Country*: Dharwar (Blatter !).

Distribution: From subtropical Himalaya south to Ceylon.

32. Gaillonia R. Rich. (Cke. i, 624).

Species 12.—Nubia to India.

1. **Gaillonia hymenostephana** Jaub. & Spach Ill. Pl. Or. i (1842) 146, t. 79; Cke. i, 624.

Distribution: Sind, Baluchistan, Punjab, Afghanistan, Waziristan.

33. Rubia Linn. (Cke. i, 625).

Species 15.—Europe, Asia, America.

1. **Rubia cordifolia** Linn. Syst. Nat. ed. 12, iii (1768) 229; Cke. i, 625.—*R. munjista* Roxb. Hort. Beng. (1814) 10; Wight Ic. t. 187.—*R. purpurea* Decne. in Jacq. Voy. Bot. 84, t. 92.

See: Daveau, J., *Dioscorea verticillata* Lamark *et Rubia cordifolia* Linn. Bull. Soc. Bot. Fr. 75 (1928) 254.—*Dioscorea verticillata* has been described from specimens without flower and fruit in the young form of *Rubia cordifolia*.

Locality: Add: *W. Ghats*: Pasarni Ghat and Panchgani to Mahableshwar (Blatter !).—*Deccan*: Near Poona (Blatter !).

*2. **Rubia tinctorum** Linn. Sp. Pl. (1753) 109; Cke. i, 626.

Cultivated in Sind.—It is the madder, formerly cultivated for its dye, alizarin, now prepared artificially.

*34. Coffea Linn.

Species 45.—Palaeotropics, especially Africa.

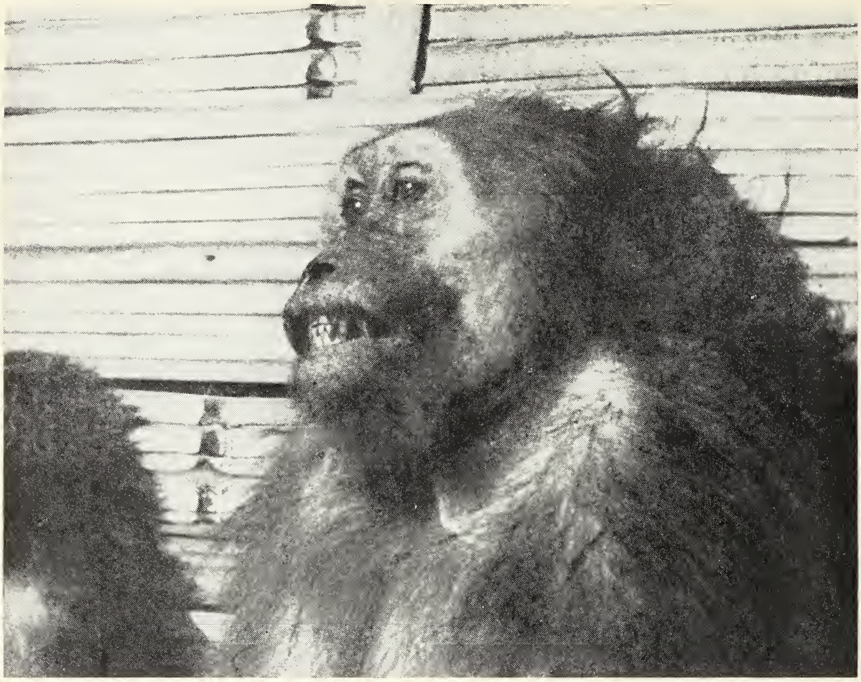
1. **Coffea arabica** Linn. Sp. Pl. (1753) 172.

Locality: *W. Ghats*: Panchgani and between Panchgani and Mahableshwar, 4,000 ft.

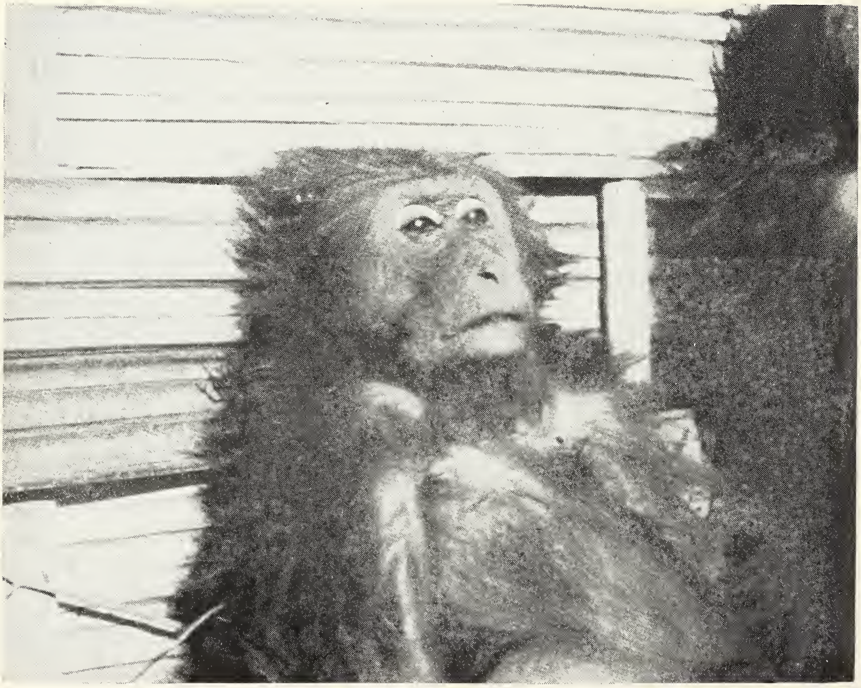
See: W. H. Ukers. All about coffee, 796, p. 77 col. pl., 102 portraits, 29 maps and diagr., 569 other ill. New York, 1922.

Ralph Holt Cheney. Coffee, a monograph of the economic species of the Genus *Coffea* Linn. New York, 1925, 244 p. 77 pl., 8 maps.

(*To be continued*).



Adult male of the Stump-tailed Macaque (*M. speciosa* F. Cuv.).



Adult female of the Stump-tailed Macaque (*M. speciosa* F. Cuv.).

Photos by Author.

NOTES ON SOME INDIAN MACAQUES

BY

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(*With 5 plates and 1 text-figure*).

INTRODUCTION.

There are perhaps few of the larger mammals so difficult to describe accurately as the monkeys in general. They are extremely varied in form and colour. What adds greatly to this difficulty is our lack of knowledge of the various colour-phases and forms they pass through from birth to maturity. In some instances there is a distinct difference between the sexes. Monkeys have been kept in captivity from the earliest times and many of the scientific descriptions have been based on captive specimens, which are, generally speaking, not at their best. Not a few descriptions have been based on poorly preserved material. To add to all this, there is yet another factor which is seldom taken into consideration, namely, the fading of skins in even the best preserved collections. Much also depends on the way the skins have been dried in the field. Experience both in the field and with museum collections has shown me that very often the most carefully preserved specimens fade in a short time; the specimens appearing unlike what they did in the flesh. The colour of the soft parts offer another stumbling block. Unless the colours are noted immediately after the animals are shot, they are frequently lost, as they fade rapidly after death. The colours of the face and hindquarters are generally accentuated in breeding individuals, a sign of sexual maturity. Immature individuals do not exhibit this trait. In the off-breeding season the colours diminish in tone or disappear.

In my opinion, the length of fur is of little or no specific importance. There is frequently a greatly marked variation in its colour and length, possibly due to season, and age. Local conditions also play an important rôle. Unfortunately, these factors only impress themselves on the field-worker after he has had varied experience. The factors taken conjointly make matters doubly difficult for the museum systematist, who has to rely on dried skins and what notes the collector may have made. Here it is that we can find an excuse for the very often incomplete and inadequate descriptions. Today it is very important that quality and not quantity collecting is required and to achieve this, mere skinners are not satisfactory.

Monkeys vary so much *inter se* in the same troop and at different ages and seasons that even the most detailed description of a single individual will not suit the next. When making a description it is perhaps a good plan to record the time of the year when the specimens were collected. This I think will help somewhat. Until such time as we are able to connect up the seasonal, local and age variation, a general description will have to suffice. What is most desirable is to collect series of species from newborn to adult whenever possible. In some species the coat and cranial characters are very different in the sexes as will be seen in the plate illustrating the skulls of the Stump-tailed Macaque (*M. speciosa* F. Cuv.) Pl. IV. In such cases it would be useful to have separate descriptions for those characters of the female and young which are not exhibited by the male.

In this paper I will deal principally with the Stump-tailed Macaque (*M. speciosa*) over which there is apparently much confusion. I shall refer to the Pig-tailed Macaque (*M. nemistrina* sub. sp.), the Rhesus Macaque (*M. mulatta*), and the Bonnet Macaque (*M. radiata*), only in order to record such observations as have come to my notice.

MACACA SPECIOSA F. CUV.

The Stump-tailed Macaque.

Macacus speciosus, F. Cuv. Hist. Nat. des Mammif. Fev. 1825, pl. xlvi.

Macacus arctoides, Is. Geoff. St. Hil. Mag. de Zool. 1833, cli, pl. ii.

Macacus maurus, Is. Geoff. St. Hil. Voy. de Bélanger Zool. 1834, p. 63.

Papio melanotus, Ogilby, Proc. Zool. Soc. Lon. 1839, p. 31.

Cynopithecus speciosus, Lesson, Sp. des Mammif. 1840, p. 102.

Inuus (Mainon) arctoides, Wagner, Schreber, Säugeth. Suppl. vol. i, 1840, p. 146.

Macacus ursinus, Gervais, Hist. Nat. des Mammif. 1854, p. 93.

Inuus (Inuus) arctoides, Wagner, Schreber, Säugeth. Suppl. vol. v, 1855, p. 57.

Pithecus (Macacus) arctoides, Dahlbom, Stud. Zool. Fam. Aeg. An. 1856, pp. 116, 118.

Pithecus arctoides, Blainville, Ostéogr. Mamm. vol. i, p. 44, 1839-64, atlas ii, pl. vii (skull).

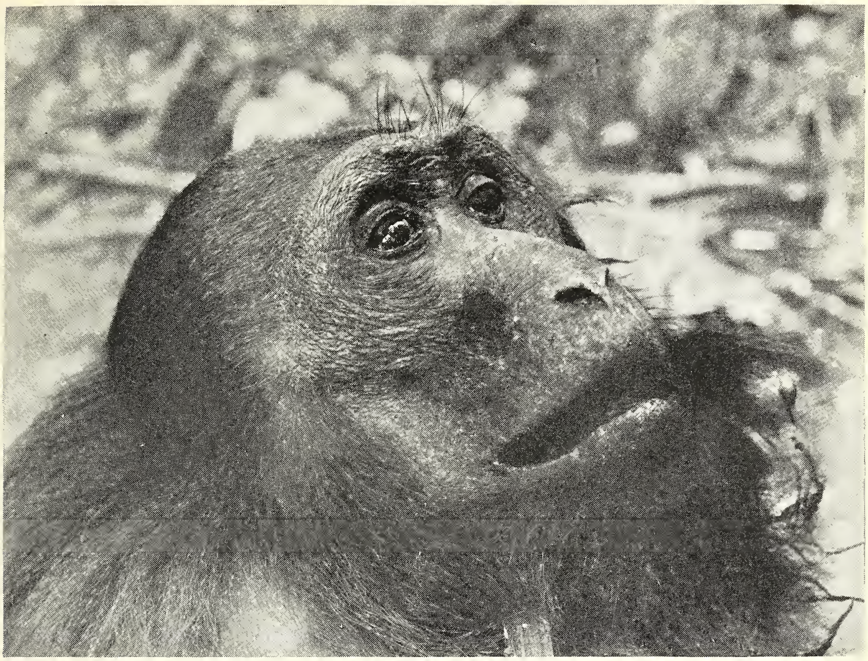
Macacus melanotus, Gray, Cat. Monkeys and Lemurs, B.M. 1870, p. 29.

Macacus brunneus, Anders. Proc. Zool. Soc. Lon. 1871, p. 628; 1872, p. 203, pl. xii (juv.); 1874, p. 652.

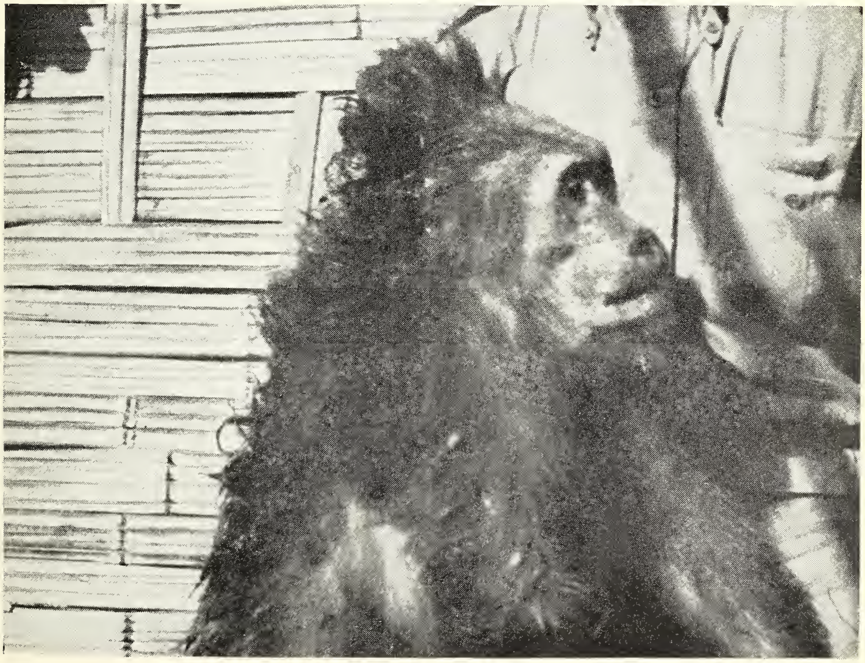
Inuus speciosus, Blyth, Journ. As. Soc. Beng. vol. xliv (1875), ex. no. p. 6.

SYNONYMY.

There has undoubtedly been much confusion in respect to the status of this species. The reason for this confusion may be due to three main causes, namely, (*a*) that the original description was based on a drawing by Duvaucel; (*b*) the lack of sufficient material; and (*c*) the lack of our knowledge of the changes, both external and internal, exhibited by this species from birth to maturity. With the material I have before me, nine specimens collected by myself and a single male collected by Mr. F. C. Lowis, I shall



' Close up ' of the face of a male Stump-tailed Macaque (*M. speciosa* F. Cuv.).



A ' Close up ' showing profile of face and long shaggy coat of a male Stump-tailed Macaque (*M. speciosa* F. Cuv.).

Photos by Author.

endeavour to fill certain gaps. All my specimens were obtained in the Naga Hills, Assam, while I was on expedition work in that region from January to March, 1930. This expedition afforded me a splendid opportunity of collecting and observing this species in its natural habitat, whenever time allowed.

I have adopted the name *M. speciosa* F. Cuv. in preference to *M. arctoides* Is. Geoff. because Cuvier's name antedates the latter by eight years. In spite of the fact that Cuvier (1825) described the animal from a drawing by Duvaucel, authorities appear to be agreed that it is the same species described by Geoffroy eight years later (1833), regardless of the fact that no locality is given to Cuvier's type and that the type does not exist. According to Anderson (*An. Zool. Res.* 1878, p. 50), the drawing made for Cuvier was of a specimen in the Barrackpore Park, and he (Anderson), after considering Temminck's view, namely, that the drawing was made of a Japanese monkey, remarks that:—

> 'There is, however, no evidence to support such a view; and within the last few years, since my attention has been directed to this subject, four examples of these brown, red-faced, stump-tailed monkeys have passed under my notice in the Calcutta market, and all of them had come from the Assam region or Cachar. As F. Cuvier's drawing of *M. speciosus* is a better representation of these monkeys, all of which are referrable to *M. brunneus* and *M. melanotus*, than it is to the Japan ape, with its differently coloured fur and rather long well-clad tail, as markedly distinct from the tail of *M. arctoides*, it seems highly probable, that F. Cuvier's drawing is founded on an animal of the Assam or Cachar region that had probably been presented to the Viceregal collection at Barrackpore by some Government official—a source from which the menagerie has been frequently enriched, and to which it has always been more or less indebted from its commencement. The second example of *M. brunneus* that came into my hands was given to me with the option of presenting it to the Barrackpore collection.
>
> 'There can be no doubt that while the drawing of *M. speciosus* is not a good representation of the Japan monkey, it is so of the form from the Cachar and the Kakhyen hills on the frontier of Yunnan; and as *M. arctoides*, which I hold to be the adult, is from Cochin China, if my hypothesis of the origin of the type of *M. speciosus* is rejected, there is the further alternative, as suggested by Temminck, that it may have come from some Javan port. If so the probability would appear to be that it was carried to Java by one of the trading vessels between that island and Cochin China and not from Japan.'

Blanford [*Fauna British India* (Mammalia) 1888, p. 18] referring to the nomenclature of this species writes:—

> 'Blyth refers the present form to *M. speciosus* of F. Cuvier, a name generally applied to a Japanese species, and Anderson is disposed to concur. *M. speciosus* is said by Temminck (*Fauna Japonica*) to have been founded on a drawing by Diard or Duvaucel of a monkey living at Barrackpur near Calcutta. The figure resembles a pig-tailed Monkey (*M. nemestrinus*) with most of the tail cut off as much as it does either *M. arctoides* or the Japanese species. I agree with Anderson that the name *M. speciosus* should be dropped.'

It is quite clear from the comparison of the respective statements of Anderson and Blanford that the former was of the opinion that Duvaucel's drawing was that of *M. speciosus* F. Cuv. and not of the Japanese monkey as stated by Blanford. Anderson merely adopted the name *M. arctoides* Is. Geoff. on the ground that the type of Geoffroy's description existed in the Paris Museum, as is clearly seen from his own remarks (l.c. p. 51): 'I have adopted the term *M. arctoides* in preference, *because the type of the former exists in the Paris Museum,*[1] whereas the latter solely rests on a drawing by Duvaucel reproduced by F. Cuvier.'

If Cuvier's description was ample to distinguish the species and he was the first to describe it, I see no reason why his name should not be accepted, as it is the oldest. In which case *Macacus speciosus* has the right of priority over *M. arctoides* of Geoffroy. The late Mr. Oldfield Thomas[2] [*Proc. Zool. Soc. Lon.* (1927), p. 43] adopts Geoffroy's name of *M. arctoides* mainly on the ground that Geoffroy's specimen has a definite locality and that the type is preserved in the Paris Museum (like Anderson), whereas Cuvier's rests on a drawing without any locality. As we have seen above, the drawing was made at Barrackpore Park and from the evidence before us the specimen probably came from Assam, which seems most likely. Mr. Pocock refers to this species under the name *M. speciosa* in his paper on *The External Characters of the Catarrhine Monkeys and Apes, Proc. Zool. Soc. Lon.* (1925), p. 1497. In a footnote to the same paper (p. 1571) Mr. Pocock says "I entirely agree with those authors who maintain that Cuvier's description and figure of *M. speciosus* apply to the short-tailed Burmese Macaque and not to the Japanese Macaque (*M. fuscata*)." Then again, Mr. Pocock (*J.B.N.H.S.*, vol. xxxv, 1931, p. 297) refers to this species as *M. speciosa* in a foot-note to his paper on 'The Pig-tailed Macaques (*Macaca nemestrina*)', but I can find no paper on the revival of this name. Undoubtedly Mr. Pocock had a good reason for adopting it. Considering the facts that: (*a*) Cuvier was the first to describe it; (*b*) though his description was based on a drawing, without locality, it was sufficient to recognise the species; and (*c*) most, if not all, systematists are agreed that Cuvier's *M. speciosus* is conspecific with Geoffroy's *M. arctoides*, there is no alternative but to accept Cuvier's name in place of Geoffroy's which it antedates by eight years.

DESCRIPTION.

Coat: In order to facilitate description, I propose to consider my specimens individually according to their approximate ages.

Newly-born: No. 12, ♂, Lakhuni, *ca* 2,000 ft., 2-2-30. This specimen was brought in alive. The general colour of the fur was creamy-white with a light brown tint showing up over the rump. A few days later similar small brown patches appeared over the scapulars. Limbs creamy-white. Tail very thinly clad with white hair. The face, hands, ears, testes and buttocks flesh-pink—the colour was slightly intensified when the animal was irritated. As the animal grew older the brown patches appeared to intensify very rapidly. The hair of the neck and shoulders was distinctly longer (27 mm.) than the rest of the body (rump 15 mm.). Unfortunately the animal died.

The following is a description of the skin in its present condi-

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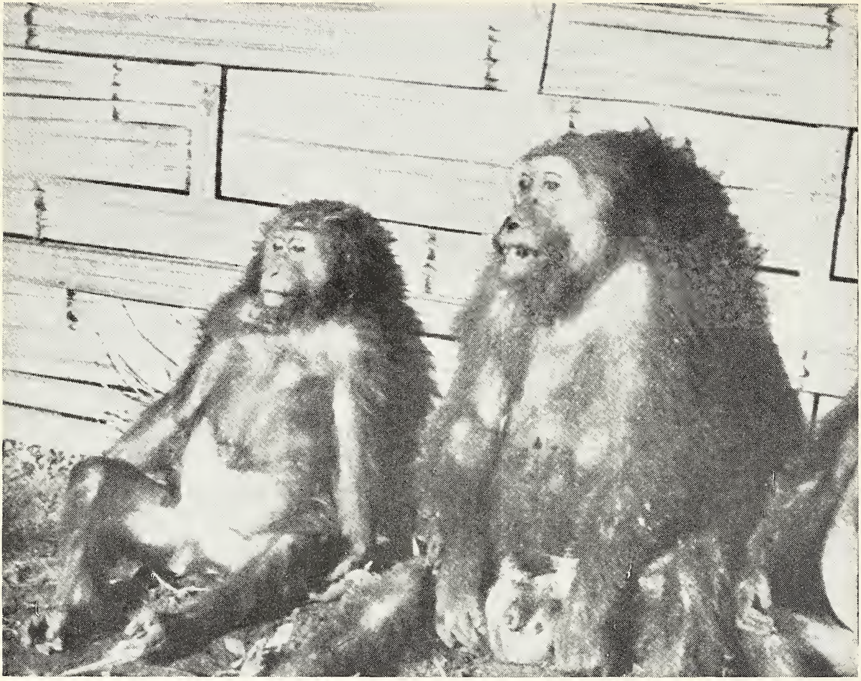
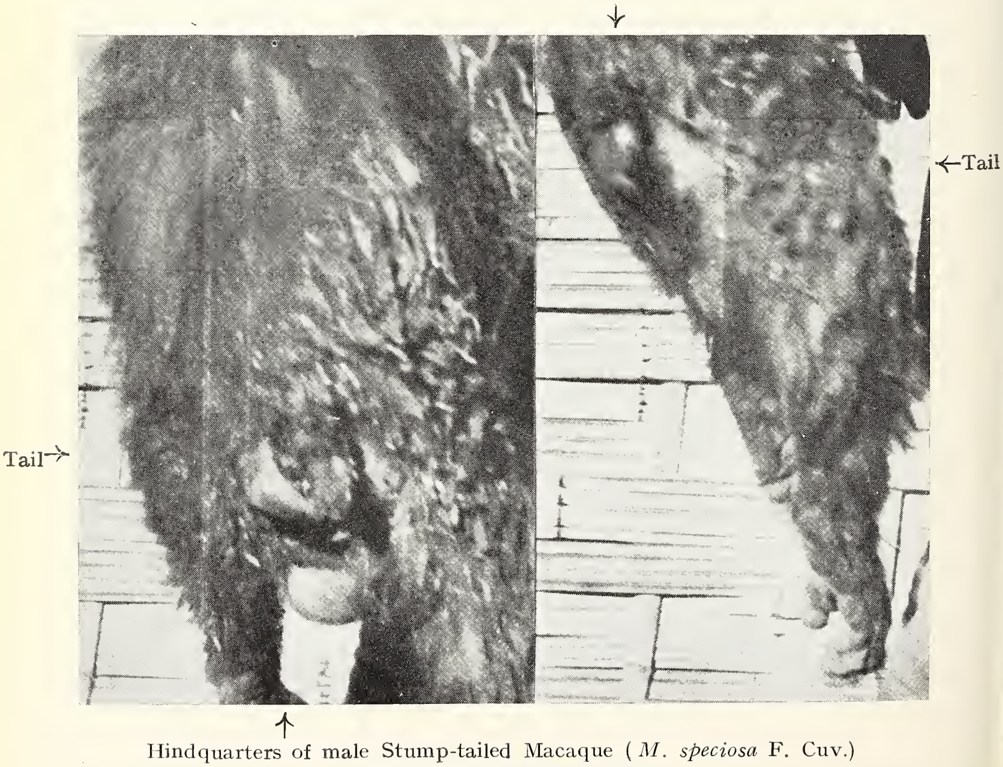
[1] The italics are mine.

[2] Mr. Thomas withdraws his opinion expressed here vide *Proc. Zool. Soc. Lond.* (1928), p. 142.



Adult male and female of the Stump-tailed Macaque (*M. speciosa* F. Cuv.).



Hindquarters of male Stump-tailed Macaque (*M. speciosa* F. Cuv.)
showing abbreviated tail.

Photos by Author.

tion, as it is of interest. Head very pale yellowish white intensifying in tone on the shoulders; small brown patches over the scapulars; the brown on the rump very marked, with a distinct spinal streak rising towards the scapulars; the limbs suffused with a very pale brown. Chest and abdomen thinly clad with light hair.

Yearling: No. 71, ♂, Changchang Pani, 500 ft., 2-2-30. General colour light brown with distinct darker vandyke-brown behind the head and on the rump. The brown appears as though it would have gradually spread all over the body. This point we shall see presently confirmed in specimen No. 135. The brown behind the head is interspersed with light hairs. There is no indication of moult. Limbs uniformly brown like the body, but paler on the insides. The colour of the face and other soft parts when in the flesh, was flesh-pink tinged with ochre. Chest and abdomen well clad with light brown hair. Hairs from the shoulders measured 37 mm. and from the rump 29 mm.

Immature females: No. 135, ♀, Changchang Pani, 500 ft., 26-2-30. General colour a rich vandye-brown throughout, the darkened portions of the hairs accounting for this colouring; below the darkened portions of the fur is greyish brown. Head slightly lighter than the rest of the body. In this specimen there is no indication of the hair being annulated. Below the chin there is a small dark beard interspersed with light hairs. Chest and abdomen thinly clad with light brown hair. Soft parts flesh-coloured tinged with ochre. Hairs from the shoulders measure 66 mm., those of the rump 38 mm. and those of the chest 52 mm.

No. 139, ♀ Changchang Pani, 500 ft., 26-2-30. In general tone this specimen is much like No. 135, but the hairs are becoming distinctly annulated throughout. Vandyke-brown alternates with bright golden yellow. There are 3-4 annulations on each hair. This individual is older than the last (No. 135) as will be seen when I come to the comparison of the teeth. The chest and the abdomen is clad with brown hair. Soft parts as in the last. Length of hairs from the shoulder 74 mm.

Adult female: No. 137, ♀, Changchang Pani 500 ft., 26-2-30. General colour brown but lighter than the two immature females. The hairs are all distinctly annulated throughout—5-6 annulations to each hair. The whole animal now presents a grizzly appearance. Head slightly lighter than the rest of the body. Face and hindquarters pinkish purple tinged with deep purple and brown patches.

Adult males: No. 131, ♂, Changchang Pani, 500 ft., 22-2-30. In general appearance like the adult female (No. 137), but decidedly darker. Head lighter than the rest of the body. Hairs distinctly annulated—8-10 annulations to each hair extending for about $\frac{3}{4}$ its length down. Face sparingly hairy, much wrinkled, the main wrinkles running transversely and with minor reticulations between. The colour is a deep pinkish purple with pink and darker shades of purple and brown blotches. The hindquarters and testes are coloured like the face, the latter being a deep purple with brown patches.

No. 133, ♂, Changchang Pani, 500 ft., 26-2-30. Much like the last (No. 131).

No. 95, ♂, Changchang Pani, 500 ft., 9-2-30. This ainmal is older than the other two males. The coat is somewhat lighter and more grizzly. Hairs of the shoulder measure 115 mm. In this specimen there are as many as 16 annluations to each hair.

Old Male: No. 97, ♂, Changchang Pani, 500 ft., 13-2-30. This solitary old male is decidedly lighter than the other males described above. The coat is interspersed with entirely grey hairs. The coat is distinctly annulated. It is the bands of bright golden yellow which go grey before the other bands of brown. The chest and abdomen are poorly clad. The vivid colouring of the face and hindquarters as exhibited by the other males was completely lost, being a sallow colour. This animal was thin and emaciated. The face was haggard and the configuration of the bones could be clearly seen—a good example of a wizened up old veteran. Other characters indicating age will be dealt with below.

A single specimen collected by F. C. Lowis is in the collection of the Bombay Natural History Society. It is an example of a male in the prime of life. It was collected 'between 20°.40′ and 26°.45′ on the western slope of Divide between Salween and Irrawaddy' in 1914. This specimen is more ferruginous along the flanks than those collected in Assam. The dorsal region is somewhat darker. The head is decidedly more grizzly above and darker behind than Assam specimens. No measurements are given.

The following gives the measurements of the animals taken in the flesh:—

No.	Sex.	Locality.	Head and body.	Tail.	Hind foot.	Ear	Chest[1]	Belly[1].	Loins[1].
97	♂	Changchang Pani, 500′ ...	585	40	185	33	355	570	334
133	♂	,, ,, ...	630	70	172	35	470	590	400
131	♂	,, ,, ...	565	76	160	35	378	554	340
95	♂	,, ,, ...	577	56	158	32	423	505	324
71	♂	,, ,, ...	345	25	83	27	...	...	...
12	♂	Lakhuni *ca.* 2,000′ ...	250	40	83	27	...	...	...
137	♀	Changchang Pani, 500′ ...	530	60	154	30	340	500	300
135	♀	,, ,, ...	500	60	150	30	335	470	290
139	♀	,, ,, ...	460	36	145	30	340	415	280

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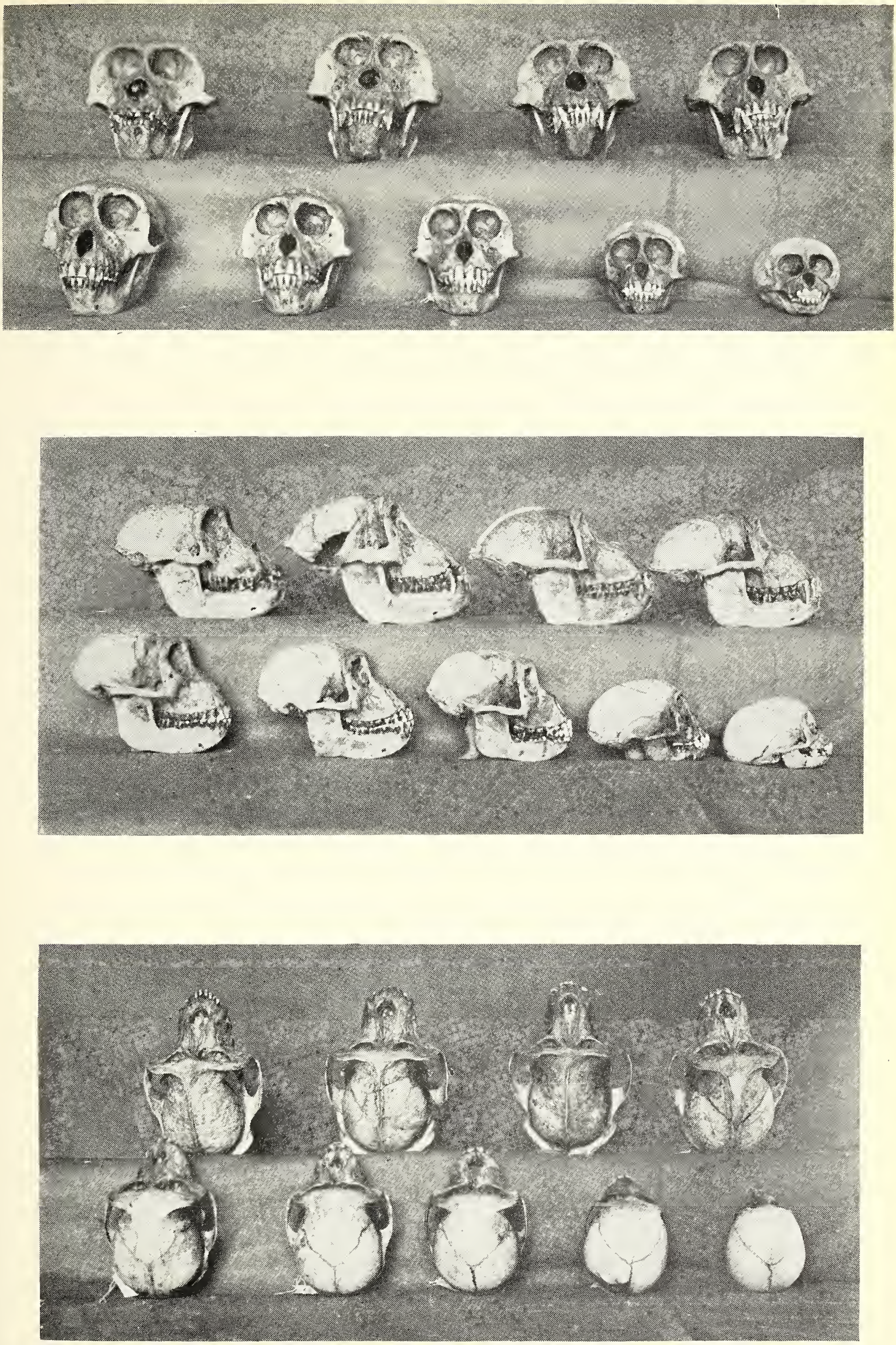
[1] The animals were slightly swollen when measured.



Skulls of the Stump-tailed Macaque (*M. speciosa* F. Cuv.) arranged according to age from left to right showing the variation of the contours. The same skulls are shown in the 3 photos.

Top row: Nos. 97; 133; 95; 131. *Bottom row:* 137; 139; 135; 71; 12.

Photos by Author.

ANATOMICAL CHARACTERS.

Vertebrae: Caudal 10, Sacral 3, Lumbar 7, Dorsal 12, Cervicle 7. Ribs 12 on each side. Caudal vertebrae very considerably reduced towards the end.

Pelvis: The following table gives the principal measurements in millimetres:—

No.	Sex.	Length.	Upper width.	Lower width.	Callos	...
133	♂	163	119	93	44	Adult.
137	♀	141	95	83	36	,,

Skulls: The following table gives the measurements of the skulls in millimetres:—

No.	Sex.	Total length.	Zygom. width.	Length of palate.	Orbit. width.	Length of molars.	Remarks.
97	♂	146	103	56	88[1] 61	40[2] 27	1st molar upper jaw right lost in life.
133	♂	156	116	63	92 60	42 28	
131	♂	141	99	57	79 56	40 28	
95	♂	151	104	55	88 60	41 28	Left lateral incisor not developed.
71	♂	93	62	30	50 41	0 15	Milk dentition complete.
12	♂	80	51	22	42 37	——	Only one molar through gums.
137	♀	122	83	46	69 51	37 25	
135	♀	115	79	44	64 49	30 18	Last molar not cut.
139	♀	127	86	48	0 53	38 26	Last molar just appearing.
nil	♂	151	102	58	82 63	37 25	Collect by F. C Lowis.

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[1] The numerator denotes the external orbital width and the denominator the internal orbital width.

[2] The numerator denotes the length of molars and premolar combined and the denominator the length of the molars alone.

Below I give the progress of the cranial characters as development takes place according to the approximate ages of the specimens:—

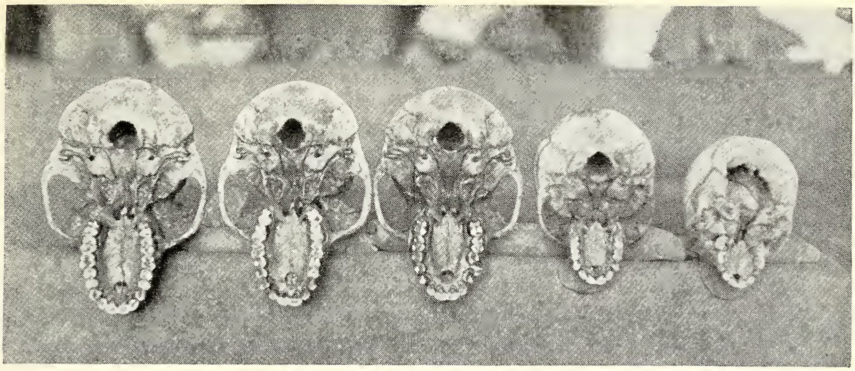
No. 12, ♂. Bones not fused. Muzzle very short; a slight indication of the postorbital process of frontal bone. Point of union of the frontals clearly visible. Orbital portion of malar bone laterally oblique; not markedly widened. Orbital ridges of frontal not pronounced. No bony partition between the palatine foramina. *Teeth*: The formula for the milk-teeth as in the genus, I. $\frac{2-2}{2-2}$, C. $\frac{1-1}{1-1}$, M. $\frac{2-2}{2-2}$. In this specimen the incisors have been completely erupted in both the upper and lower jaws. Canines have just pierced the gums. 1st molar in both jaws erupted, quadri-cuspidate; the lower molars are slightly longer than the upper.

No. 71, ♂. The dovetailing of the cranial sutures distinct. Frontals completely fused; muzzle silghtly more protruded than in No. 12. Postorbital processes of frontals distinctly prolonged into a sharp point. Orbital portion of malar wider and its face directed more forward. Orbital ridges of frontals distinct. Slight indication of septum between the palatine foramena. *Teeth*: Full set of milk-teeth erupted; incisors show signs of wear. Canines fully cut.

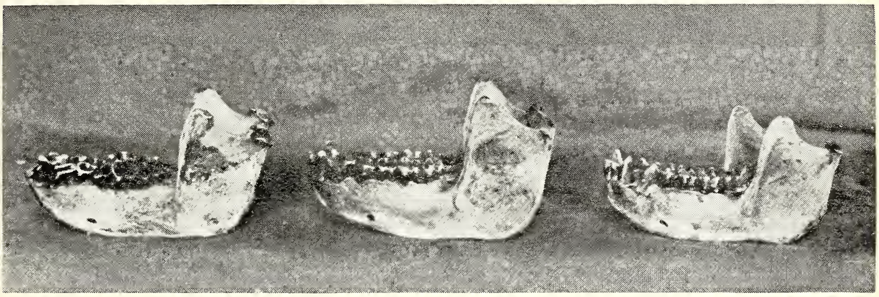
No. 135, ♀. Bones completely fused. Muzzle pronounced. Postorbital processes of frontals distinct and well developed; orbital portion of malar wide with its face directed forward. Two distinct cranial ridges arise from the orbito-malar suture and traverse the cranium in a backward curve. Septum of palatine foramena formed. *Teeth*: Formula for permanent set as in the genus— I. $\frac{2-2}{2-2}$, C. $\frac{1-1}{1-1}$, Pm. $\frac{2-2}{2-2}$, M. $\frac{3-3}{3-3}$. In this specimen only 28 teeth have been erupted. The incisors exhibit considerable wear in the upper jaw, the cutting edges have been worn down flat; in the lower jaw the chisel edges are retained; canines pre-molars and the 1st and 2nd molars only erupted. The wear indicated by the 1st molar shows that it is erupted before the premolars. In the lower jaw the 2nd premolar of the right side has not been cut, but the new tooth is visible in the cavity.

No. 139, ♀. Bones as in the last but showing greater strength and development. The cranial ridges are more clearly pronounced. *Teeth*: The condition of the teeth in this specimen is as in the last (No. 135) except that the last molars of the upper jaws are just cutting the gums, while those of the lower jaw have been almost completely erupted. The premolars show slight signs of wear.

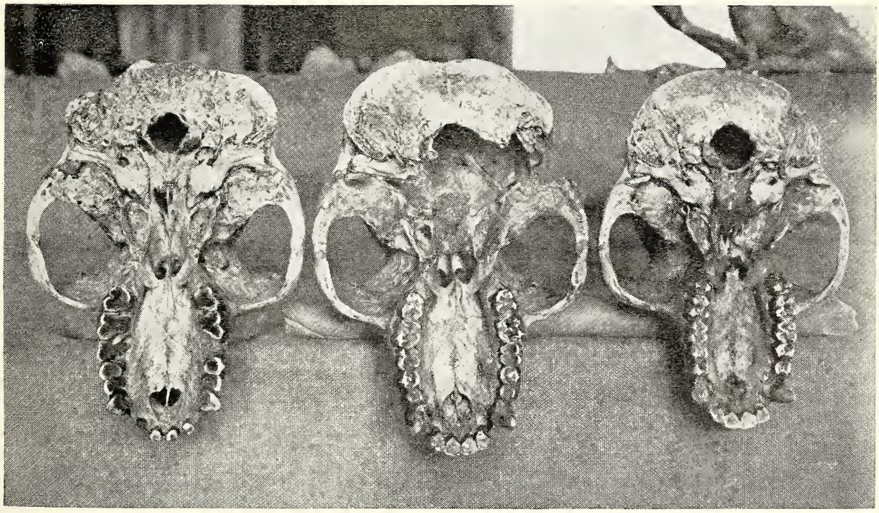
No. 137, ♀. Bones as in the last. Cranial ridges converging towards one another. In the females the cranial ridges do not fuse to form a single crest as in the males. *Teeth*: All the teeth with the exception of the last molars show signs of wear; the



Nos. 137; 139; 135 71; 12.



Nos. 97; 133; 131.



Nos. 97; 133; 131.

Skulls and lower jaws of the Stump-tailed Macaque (*M. speciosa* F. Cuv. showing the dentition.

Photos by Author.

inner cusps being worn down before the outer in the upper jaw, while in the lower it is the outer cusps.

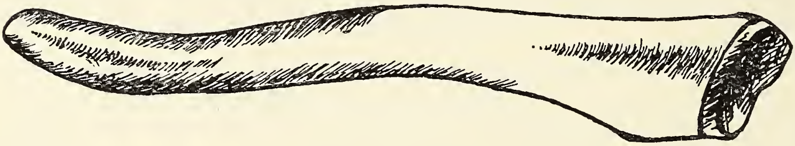
No. 131, ♂. An adult male in the prime of life. The two cranial ridges prominent, converging from the orbits over the cranium to the occipital ridge, the latter fairly prominent. *Teeth*: Full set of permanent teeth present; last molars newly erupted in both jaws. The 1st premolar of lower jaw slopes obliquely and forward from the apex of the cusp down to its anterior root, its anterior surface articulates with the upper canine and acts as a 'hone' to keep the sharp backwardly directed edge of the latter keen. The deep groove on the anterior surface of the canine narrow. All the teeth with the exception of the last molars show signs of wear.

No. 133, ♂. The condition of the skull as in the last but the cranial ridges are beginning to fuse to form the cranial crest. Occipital ridge more highly developed to form a 'shelf' (*ca.* 8 mm. broad) across the base of the skull. *Teeth*: The canines somewhat larger than in the last example (No. 131) but considerably worn, the lower canines showing greater wear where they articulate with the teeth above. The sharp posterior ridge not so keen as in the previous specimen; the groove on the anterior surface wider and shallower. The cusps of all the molars have been greatly worn down.

No. 95, ♂. Cranial characters as in the last save that the cranial ridges have completely fused to form a single crest. *Teeth*: A curious point about the teeth in this case is that in the upper jaw one of the lateral incisors of the left side was either not erupted or was lost early in life with the result that the remaining three teeth have centralised themselves over the four lower ones. The two right incisors being obliquely positioned and in consequence showing greater wear than the single one on the left. The premaxilla of the right side is also slightly broader than and out of alignment with its neighbour. In spite of this rearrangement of the teeth the interval between the canines and incisors is equal on both sides.

No. 97, ♂. This is perhaps the most interesting skull as it indicates the wear of the teeth due to age. Most of the teeth are worn down almost to the roots. The incisors are worn down flat in both jaws; roots very near the surface. Canines worn flat or nearly so in the upper jaw, in the lower, two blunt projections with hollows between, corresponding with the articulation of the upper teeth remain. Premolars worn down to almost the bifurcation of the roots. The 1st molar of the right upper jaw has been shed and the cavity is filled with bone. In all the molars they have been worn down to almost root-level. The roots of all the teeth are near the surface of the irregularly margined sockets. The sockets have been filled from below with bone thus pushing the roots nearer and nearer the surface. In the upper jaw the wear of the teeth slopes from the outer margin to the inner whereas in the lower it is the reverse. In some cases the wear is so pronounced that the separation of the roots from one another (of the same tooth) is very near. There does not appear to be any signs of dental decay. In this skull the premaxillary bones are of a spongy texture.

Baculum: The baculum of No. 131 measured 57 mm. in length; its greatest diameter at the proximal end is 7 mm., while the distal extremity 3 mm. The proximal portion is strongly laterally compressed forming a ridge some 18 mm. in length above, while the lower portion is rounded. After this it is rounded for a short distance, then it is once more laterally compressed to almost the extremity. The distal end is rounded. Below, the baculum is rounded throughout its length. The figure indicates its shape. The specimen described by Anderson (*P.Z.S.*, 1872, p. 209) is evidently of a very young animal.



Baculum of adult Stump-tailed Macaque (*M. speciosa*).

General Observations.

These monkeys are robust, powerful animals with short limbs, the hindlegs being shorter than the fore, the body line sloping down from the shoulder to the rump. The coat is long, thick and shaggy varying in colour according to age (and possibly season). A curious fact arises from the comparison of the skins and teeth in relation to the annulation of the fur. There appears to be some correlation between these two characters. In my specimen No. 135, a young female, the coat is entirely brown and shows no signs of annulation. The last molars have not been erupted and an examination of the jaw shows that they would have been cut only after a considerable time. In specimen No. 139, another young female, but evidently older than No. 135, clearly shows the fur becoming annulated and in this specimen the last molars are just being erupted, hence I conclude that there must be some evident relation between the appearance of the last molars and the annulation of the fur—possibly an indication that the animal is nearing maturity.

It is clear from the evidence that we now have before us that this monkey passes from a creamy-white phase, through a brown juvenile phase, and then eventually becomes grizzly, which is the adult phase. Coupled with the change in coat, there is the colouration of the face, which is a sign of sexual maturity.

The limbs are short and powerful, well adapted to a terrestrial habit. The tail is very short and kincked in old animals, a point already noticed by Anderson, with the dorsal surface devoid of hair as it is sat upon. In the juvenile stage it is carried erect in an upward curve resembling a U-tube. In old animals it is hardly, if at all, erected. Hence the animal appears tailless.

The males are considerably larger than the females. The testes are extremely large, another indication that this species is terrestrial in habit, as in monkeys that are more arboreal the organ is not so large. In the skulls there is considerable difference and contour. The largest male skull obtained by me scaled 156 mm.

Distribution.

Little definite information is available with regard to the distribution of this species. Cuvier's type was in all probability from Cachar (as indicated above) and Geoffroy's type is from Cochin China. No specimens were collected by the Society's Mammal Survey. According to Anderson, this species has a wide distribution and probably he is right. It appears to be distributed in the hilly tracts of Upper and Lower Assam, Naga Hills, Upper Burma and probably throughout the hilly districts of Lower Burma, the Malay Peninsula, Siam and Cochin China. In the Naga Hills I secured them at elevations ranging between 500-1,800 feet. The specimen from the Salween-Irrawaddy Devide (F. C. Lowis) was shot at 5,000 feet above sea level and the one seen by Davison and Bingham at Mulyit, at an elevation of 7,000 feet. The specimens collected by me were obtained during the winter months. Probably the species goes to higher altitudes during the hot weather.

Habits and General Notes.

The newly-born specimen was brought in alive and together with it the yearling No. 71, but as the latter was badly injured I put it out of its misery. The former was kept alive for some days but one evening it found its way into a basin of water and caught a death of cold. Nobody in the camp was anxious to keep this little fellow on his person on account of the very strong unpleasant odour emitted by it which remained on the clothes. Being very young it naturally wanted to cling to somebody, a common trait in all young monkeys. When approached it made the usual grimaces customary with macaques and would squeal to be taken up. This was my first introduction to the Stump-tail in the flesh.

Being naturally interested in the two young specimens I was anxious to obtain adults. Locally the Stump-tail is known as the *Chantee* and is fairly common in the Naga Hills. These animals go about in large parties composed of 25 to 30 individuals of varying ages and of both sexes. However, there seems no doubt that there is a single leader of the troop. They are extremely noisy and appear to fear nothing, at times not even Man. Owing to the dense nature of the forest they are not easy to obtain moving away rapidly through the undergrowth if alarmed.

The Stump-tail is essentially terrestrial, feeding for the greater part on the ground and only ascending trees for the sake of leaves or fruit, and when danger threatens, and that only when pushed to it. These animals are very troublesome to the Naga cultivators doing considerable damage to the crops, like the Rhesus in the plains. Potato fields have a special attraction for them, thus depriving the Nagas of the little they do cultivate. According to the Nagas, when chased from the fields, they frequently show fight. I do not discredit this as when one of a troop is shot others will attempt to retrieve the wounded one in the face of a gun. They are apparently very pugnacious when disturbed. The Nagas are somewhat timid of them at times on account of their vicious habits. Possibly they may attack a lone man or woman. Some of the Naga tribes eat the flesh.

The alarm note is a short harsh bark. When feeding they keep up a continuous squealing and chattering. On the ground where a party of these monkeys has been feeding there are to be seen innumerable scratchings and holes, made by them in their quest for roots and tubers.

Solitary males are occasionally found but these are generally veterans which have been driven out of the troop by stronger opponents. The old male (No. 97) that I secured was an excellent example of old age exhibited by animals. The faded and greying coat, coupled with the condition of the teeth clearly indicate that animals do grow 'old and grey' if they are able to escape their enemies and die eventually from starvation occasioned by their worn teeth and eventual loss of them. In this example we see senile decay in the true sense of the word. A condition rarely seen in Nature, as animals are generally destroyed long before they can become old.

Blanford [*Fauna British India* (Mammalia), p. 9] under the subtitle of 'Habits of *Hylobates lar*' writes:—

> 'At the same time there appears to be a large, not yet identified, ape in the mountains of Tenasserim, but whether it belongs to the anthropoid apes, or is a large tailless or nearly tailless *Macacus*, it is impossible to say. The only observers who have seen this animal, so far as I am aware, are Mr. W. Davison and Captain C. F. Bingham. The former writes to me that when collecting birds for Mr. Hume, on Muleyit, a mountain about 7,000 feet high, east of Moulmein, he came suddenly on a number of monkeys feeding on the ground in a very dense part of the forest. He had a good look at one standing erect about 10 feet away, and considered it too large for a *Hylobates*, as its height was about 4 feet. It was, in front a deep ferruginous colour, and as it moved away it was distinctly seen to be tailless. Mr. Davison does not remember the colour of the back, but thinks that it was the same as the underparts.'

In the above description, I clearly see that the supposed ape is no other than the Stump-tailed Macaque, which certainly appears to be absolutely tailless at first sight. With regard to the erect posture, this is quite in accordance with this species as it stands up to investigate, so do also other Macaques. It remains in the upright position for quite a long time following the actions of the intruder. Blanford himself (l.c., p. 18) was inclined to this view. He writes: 'It is quite possible, too, that the large tailless ape seen by Mr. Davison and Captain Bingham in the Tennasserim mountains, and described in the notes on *Hylobates lar* (*ante*, p. 9), may be an ally of *M. arctoïdes*, though probably much larger than that species.'

FOOD.

These monkeys are probably omnivorous, but I have found that they feed largely on leaves, roots and fruit. Some of those that I secured had their pouches crammed with leaves that had been partially chewed. The contents of a single pouch of a male revealed a mass of leaves, and five mature seeds of a palm, *Zalacca secunda*, Griff., one of the few spiny plants in these hills. Each seed is almost round and about an inch or more in diameter, and ever so hard. One of the seeds had been partially eaten. The young example I had alive would eat almost anything by itself, plantains, rice and milk (tinned milk, as fresh milk was unobtainable).

MACACA NEMESTRINA sub. sp.

The Pig-tailed Macaque.

This species inhabits the same forests as the Stump-tailed Macaque (*M. speciosa*) but is by far more arboreal, and keeps strictly to the dense evergreen forests. In the Naga Hills I found it somewhat difficult to obtain or observe owing to the dense nature of the jungle. I was only able to secure four specimens, three females and one immature male. Two of the four were collected for the American Museum of Natural History, New York, and two are now in the collection of the Society.

The two specimens in the Society's collection agree fairly well with one collected by Mr. G. C. Shortridge at Bankachon (No. 4624, 4-2-15), named *M. adusta* Miller, but have much longer and darker coats. The hairs are distinctly brown-tipped, particularly along the lower dorsal region. In my specimen No. 84, the short beard is distinctly rufous and so also the inner sides of the thumbs. The feet somewhat darker than the rest of the body. The lower part of the abdomen slightly, but distinctly rufous. The tail darker brown above. The face and hindquarters flesh-coloured and somewhat ochreous. Crown of the head dark in both specimens. Eyes light brown. All the females had foetus in the womb.

The following tables give the body and skull measurements in millimetres:—

No.	Sex.	Locality.	Head and body.	Tail	Hind-foot.	Ear.	Chest[1].	Belly[1].	Loins[1].	...
93	♂	Changchang Pani, 500′	495	200	165	36	...	...	...	...
84	♀	,, ,,	...	...	...	...	...	...	...	...
120	♀	,, ,,	555	190	150	33	332	355	260	..
122	♀	,, ,,	490	180	140	33	325	424	275	...

Measurements of skulls in millimetres.

No.	Sex.	Total length.	Zygo. width.	Length of palate.	Orbit. width.	Length of molars.
84	♀	120	77	48	$\left\{\frac{59}{51}\right.$	$\left\{\frac{33}{24}\right.$
120	♀	120	82	50	$\left\{\frac{61}{50}\right.$	$\left\{\frac{35}{25}\right.$

This species is known to the Nagas as the *Kangh*. It is a rather shy animal keeping to the tree tops in case of danger. I have only once heard the call of this animal, a sort of short note, which may be interpreted by its vernacular name—*Kang*. Whether it is the note of alarm or not I am quite unable to say. The food consists of leaves and fruit. In this species the testes are very considerably smaller than in the case of the Stump-tail, no doubt in keeping with its more arboreal habits. They are coloured like the face. As I did not get any mature males I am unable to say what the mature colouring is like.

Judging from the condition of the embryos, it is possible that this species breeds about April or May.

The specimens secured by me when in the flesh appeared like *M. lioninus* as figured in the *Proc. Zool. Soc. Lon.* 1870, pl. xxxv, p. 664.

MACACA MULATTA Linn.

The Rhesus or Bengal Macaque.

This species varies much in colour of the coat in the same troop depending probably much on sex and age. The males are decidedly more heavily built than the females. There is much change of colour of the face in breeding animals. The face and buttocks are a bright reddish-pink but otherwise a pale yellowish flesh tint. These animals possibly breed the year round but of this point I am not certain. Many of the young appear to be born during the cold season.

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[1] The animals were slightly swollen.

The Rhesus roams about in large parties composed of 50 to 60 individuals of all ages and of both sexes. On the whole this species is terrestrial in habit, preferring the open plains to the forest clad country. In Assam I have found that they inhabit the margin of the forest and the open plains but do not enter the densely forested areas. They abound in the plains of the United Provinces and are very destructive to crops. In the United Provinces I have frequently seen these animals sporting in the canals during the hotter parts of the day. They are good swimmers. Young and old are fond of water. They stand on the bank, jump in and then swim ashore to repeat the action. In this way they cross some of the broadest canals, the very young clinging to the mother's back and being thus conveyed across.

MACACA RADIATA Geoff.

The Bonnet Macaque.

The Bonnet monkey is much more arboreal than the Rhesus. It inhabits forested areas and rocky cliffs and wanders about in parties. The troops are smaller than in the case of the Rhesus. Their longer tails, darker coats and the radiating hairs on the crown readily distinguish them from the Rhesus.

The Bonnet Macaque is quite common in the hills of Southern India where it ascends to about 5,000 feet—I have not seen it higher. It is likewise quite common in the Western Ghats. At Khandala it is frequently met with on rocky cliffs and in the forests. It is also plentiful, but shy on the hills of Salsette Island and Trombay. In Salsette I have observed this species feeding on the flowers of *Butea Frondosa* and the young shoots and fruits of *Dalbergia Sissoo*. They are very destructive feeders tearing off far more than they require.

The alarm note is a short sharp *Char-rac* repeated at intervals as long as the intruder is in view.

DESCRIPTION OF A NEW RACE OF THE WHITE-EYE (*ZOSTEROPS PALPEBROSA*).

BY

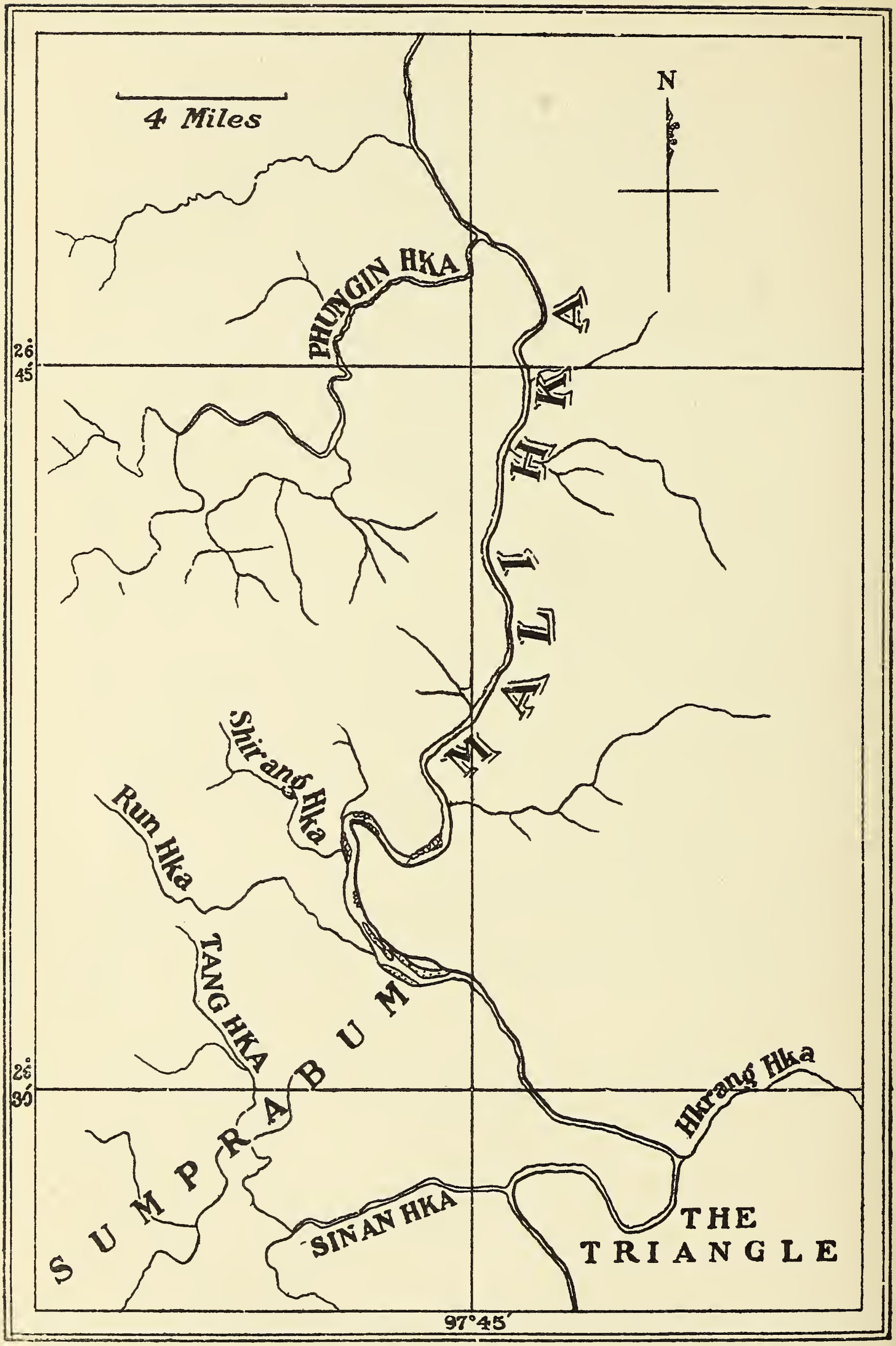
HUGH WHISTLER, M.B.O.U.

I have had occasion recently to study the White-eyes of India in connection with the fine series obtained by Mr. LaPersonne in the Vernay Eastern Ghats Survey and by Mr. Salim Ali in the Hyderabad and Travancore Surveys. I find that the specimens obtained in various ranges of the south-eastern ghats, viz. the hills in extreme south-eastern Hyderabad (Mananur and Farahabad) and the Nallamallais, the Shevaroys and the Chitteri range in the Madras Presidency cannot be attributed to either *Zosterops palpebrosa palpebrosa* (N.-E. India), *Z. p. occidentis* (N.-W. India) or *Z. p. nilgiriensis* (S.-W. India). The upper parts are a very clear yellow-green, yellower even than in *occidentis*, the bill is very small and fine, and the lower parts have very little of the dark wash noticeable in the other races. This form approaches the Ceylon form *Z. p. egregia* but can be separated from it by being neither quite such a rich golden yellow above, nor so deep a yellow on the throat, and by the finer and shorter bill. The bill in *egregia* measures 12-13 mm., the majority being 13 mm., whereas in this new race 10 males have the bill 11.5 to 12 mm. in length. For this new race I propose the name

ZOSTEROPS PALPEBROSA SALIMALII subsp. nov.

Type.—Hyderabad Survey No. 166. ♀ 18-10-1931, Farahabad 2,688 ft., S.-E. Hyderabad (deposited in the British Museum).

Named after Mr. Salim A. Ali in recognition of his careful work in connection with the Ornithological Survey of Hyderabad State.


4 Miles
N
26° 45′
26° 30′
97°45′
PHUNGIN HKA
MALI HKA
Shir'ang Hka
Run Hka
TANG HKA
SUMPRABUM
Hkrang Hka
SINAN HKA
THE TRIANGLE

R. Bagchi *del.*

Sketch Map showing the provenance of Lt.-Col. R. W. Burton's collections of fishes from the tributary streams of the Mali Hka River in Upper Burma.

REPORT ON BURMESE FISHES COLLECTED BY LT.-COL. R. W. BURTON FROM THE TRIBUTARY STREAMS OF THE MALI HKA RIVER OF THE MYITKYINA DISTRICT (UPPER BURMA).

BY

DEV DEV MUKERJI,

Zoological Survey of India, Calcutta.

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Zoological Survey of India, Indian Museum, Calcutta).

PART I.

(*With one map, 3 plates and text-figures* 1 *to* 3).

INTRODUCTION.

Burma is a land of surprises for the ichthyologist. Its fish fauna is very rich both as regards the number of individuals and in the variety of forms. In addition to a number of endemic species, it includes forms which are identical with or related to Indian fishes, particularly those found in the adjacent provinces of Bengal and Assam; while there are others which are essentially Chinese or Indo-Australian in their affinities. The inland fish-resources of the country are enormous, and fisheries, both in Upper and Lower Burma, which materially "contributed to the revenue of the country before the days of the British occupation, are still one of the most profitable of the assets of the Province".[1] Dr. Francis Day's *Report on the Fresh-water Fish and Fisheries of India and Burma* (1873) includes a valuable account of these fisheries and may be referred to in this connection.

Unfortunately, our knowledge of the ichthyology of Burma is still very limited. Apart from Day's *Fishes of India* and the fish volumes in the *Fauna of British India*, which include accounts of only a certain proportion of both the endogenous and exogenous Burmese fishes, no exhaustive account of the freshwater fishes of this country, based on an extensive faunistic survey, has so far been published. The following reports dealing with the fishes of Burma may be specially mentioned.

1. The name of Major Berdmore will always remain associated with the fish-fauna of Burma, as he was perhaps the first naturalist to make a fairly representative collection of fishes from the Sitang River and its tributaries in the Tenasserim District of Lower Burma. A report on this collection was published by Dr. Edward Blyth in 1860.

2. The most important contribution to the Burmese ichthyology, after Blyth's account of the fishes of the Sitang River,

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[1] *The Imperial Gazetteer of India* (New ed.), IX, p. 208 (1908).

is that of Dr. D. Vinciguerra (1889), which appeared about thirty years later. This excellent report is based on the extensive collections made by M. Leonardo Fea during his travels through the different districts of Burma.

3. In order of publication Dr. G. A. Boulenger's (1893) "List of fishes collected by Mr. E. W. Oates in the Southern Shan States and presented by him to the British Museum" is the next account of Burmese fishes.

4. Dr. N. Annandale's (1918) account of the "Fish and Fisheries of the Inlé Lake" is a unique contribution to our knowledge of the fish and fisheries of the Burmese lakes. The collections which were made by him chiefly in the Inlé Lake and in the neighbouring fresh-waters of the Hehó basin in the Southern Shan States, comprise amongst others a number of remarkable endemic lake forms.

5. A collection of fishes from the hitherto unexplored mountain streams of the Putao Plains (Hkamti Long) on the northern frontier of Burma, was made by Dr. Murray Stuart and reported on by Dr. B. L. Chaudhuri (1919). Several extraordinary and new forms were found in the collection.

6. Since Dr. Annandale's faunistic survey of the Inlé Lake, the Indawgyi Lake of the Myitkyina District in Upper Burma, the largest lake in the country, was explored by a party of the Zoological Survey of India, led by Dr. B. Chopra, in 1926. A more or less thorough survey of the lake and of the adjoining streams and freshwaters of the Indawgyi area and of certain other mountain-streams of the Myitkyina District was made, and the extensive collections, brought back by the party were reported on by Dr. B. Prashad and myself (1929). Several remarkable endemic forms found in the lake and the adjoining streams are dealt with in detail in this paper.

7. Of a number of occasional reports on small collections of Burmese fishes published from time to time by Dr. S. L. Hora, his revision of the "Loaches of the genus *Nemachilus* from Burma" (1929) is of the greatest value.

Besides these above mentioned important publications which deal exclusively with the Burmese fishes, other small but useful notes and lists have also been published by various authors from time to time. The existing accounts of the fishes of the countries lying in the immediate neighbourhood of Burma, such as Siam, Yunnan etc., also have a considerable bearing on the fish fauna of Burma; but it has often been a matter of difficulty to the systematists to readily get at such scattered references. Dr. G. S. Myers (1924) published a list of references on the ichthyology of Burma; but this list, though very useful, is not exhaustive. The list of references given at the end of the present report is not intended as a complete bibliography, but it includes almost all the important publications on the fishes of Burma.

The present report is based on a collection of fishes made in March, 1930, by Lt.-Col. R. W. Burton in the three tributaries, *viz.* Phungin Hka, Sinan Hka and Tang Hka of the Mali Hka River of the Myitkyina District of northern Burma lying between

Lat. 26°25′ and 26°45′ (*vide* Map).[1] The Mali river flows due south through the Shan State of Putao (Hkamti Long) and passes through the wild hilly tracts inhabited by the Kachins to its junction with the 'Nmai Hka, the eastern branch of the Irrawaddy.[2]

Through the courtesy of Mr. S. H. Prater, the Curator of the Bombay Natural History Society, the collection was received by the Zoological Survey of India in June, 1930, and was kindly placed by Dr. S. L. Hora in my hands for study and report. Unfortunately, the pressure of other work has caused considerable delay in the preparation of a report on this collection.

The fishes dealt with in this paper are of special interest, as they were collected in a hitherto unexplored area of northern frontier of Burma, where streams and rivers are not easily accessible. In forwarding his collection Col. Burton remarked:

"To collect fish in these parts one wants more time at each halting place without thought of pushing on in hopes of catching fish for sport.

I have but very little to say concerning the fish. In these Kachin Hills all is food that comes to the people whether fish or flesh in any form. They come to search the river sides for all sorts of water insects and put them into the cooking pot. So all the fish are edible. The Kachins are expert at obtaining fish by traps and sieves of bamboo, by poisoning pools with crushed leaves, 'milk' of certain trees, etc., and by damming up streams. It is only the deepness and rapidity of the main streams and many tributaries also which save the fish supply from serious depletion.

I think there shall be 80 species available. I have only got 50. There are fish up these rivers which occur nowhere else. I feel sure new varieties will be forthcoming.

The country is very difficult and Mali river only accessible at certain places; but it is close to a motorable road for 50 miles north of Myitkyina. Further north it can only be got at here and there, until it gets to the Putao District where it has many tributaries and is more easily accessible. That is over 200 miles and I only went up 130 or so. I rather wish I had gone on, but I was poorly equipped for such a climate, incessant rain and thunderstorms, more difficult paths for miles etc. One wants plenty of time and no thought of doing anything else."

This throws sufficient light on the merit and the importance of the collection of fishes from these areas, and although there is only one new form in Colonel Burton's catches, they are, as he expected, none the less interesting. The collection contains 78 specimens comprising 32 different species belonging to the families, Siluridae, Amblycepidae, Sisoridae, Psilorhynchidae,

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[1] According to Colonel Burton's field-notes the area from which he made collections is confined to Lat. 26°30′ and 26°45′. But on referring to a map of the localities concerned I find that the tributary Sinan Hka does not lie within this area. It is situated between Lat. 26°25′ and 26°45′.

[2] Hertz, W. A.—*Burma Gazetteer, Myitkyina District* (Rangoon, 1912).

Homalopteridae, Cobitidae, Cyprinidae, Belonidae, Nandidae, Mastacembelidae and Ophicephalidae. I give below a complete list of the species obtained from the tributaries of the Mali river:

Siluridae:
- *Silurus cochinchinensis* Cuv. & Val.
- *Callichrous bimaculatus* (Bloch).
- *Aoria cavasius* (Ham. Buch.).
- *Aoria* (*Macronoides*) *dayi* (Vincig.).

Amblycepidae:
- *Amblyceps mangois* (Ham. Buch.).

Sisoridae:
- *Glyptothorax sinense* (Regan).
- *Pseudecheneis sulcatus* (McClell.).

Psilorhynchidae:
- *Psilorhynchus balitora* (Ham. Buch.).

Homalopteridae:
- *Homaloptera rupicola* (Prashad & Mukerji).

Cobitidae:
- *Botia hymenophysa* (Bleek.).
- *Nemachilus botia* (Ham. Buch.).
- *Nemachilus paucifasciatus* Hora.
- *Nemachilus multifasciatus* Day.
- *Nemachilus kangjupkhulensis* Hora.

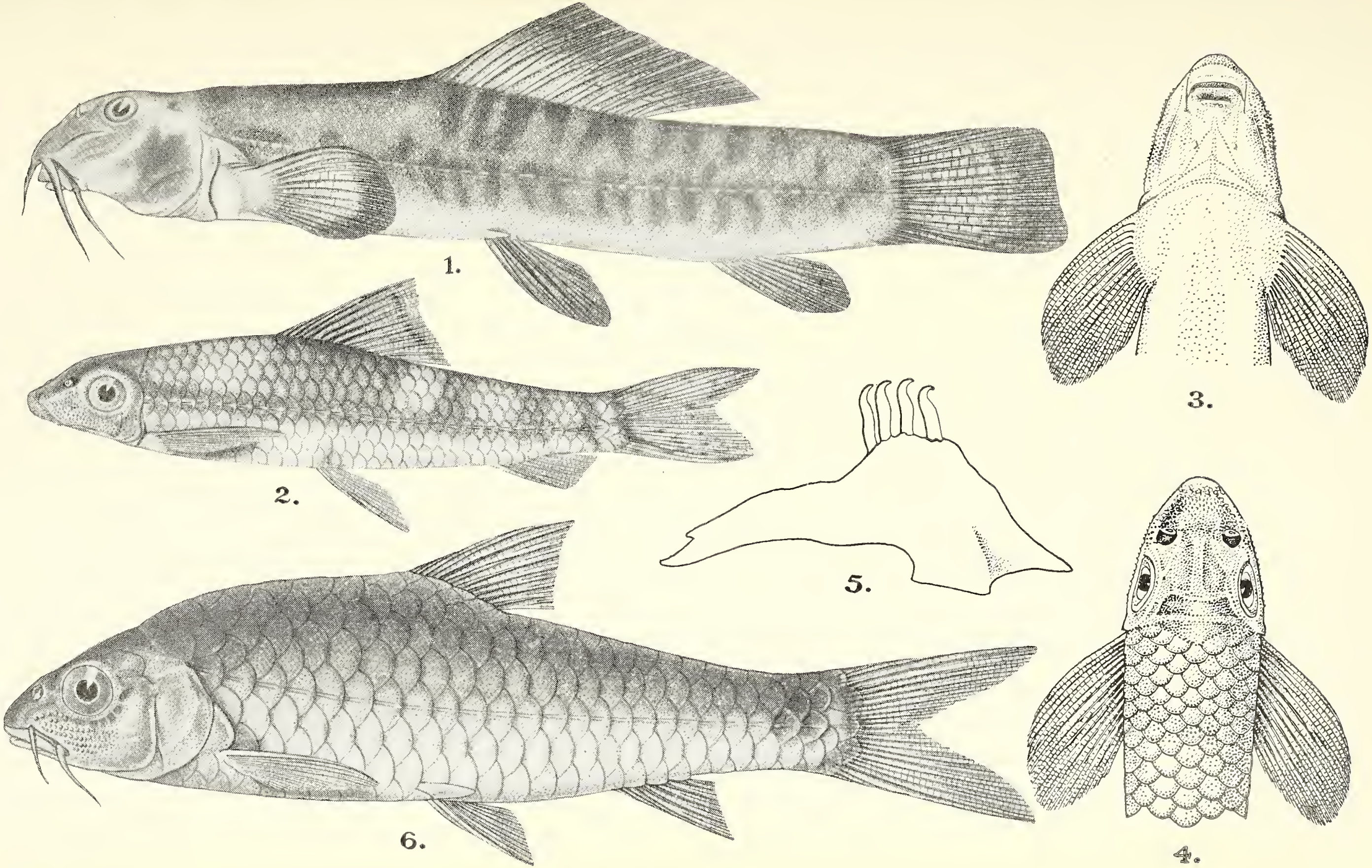
Cyprinidae:
- *Garra lamta* (Ham. Buch.).
- *Crossochilus latius* (Ham. Buch.).
- *Labeo* (*Labeo*) *dyocheilus* (McClell.).
- *Barbus compressus* Day.
- *Barbus tor* (Ham. Buch.).
- *Barbus clavatus burtoni*, subsp. nov.
- *Barbus chagunio* (Ham. Buch.).
- *Barbus chola* (Ham. Buch.).
- *Barbus sarana caudimarginatus* Blyth.
- *Semiplotus semiplotus* (McClell.).
- *Rohtee duvaucelii* (Cuv. & Val.).
- *Barilius barna* (Ham. Buch.).
- *Barilius barila* (Ham. Buch.).
- *Danio* (*Danio*) *aequipinnatus* (McClell.).

Belonidae:
- *Xenentodon cancila* (Ham. Buch.).

Nandidae:
- *Badis badis* (Ham. Buch.).

Mastacembelidae:
- *Mastacembelus armatus* (Lacép.).

Ophicephalidae:
- *Ophicephalus gachua* (Ham. Buch.)



R. *Bagchi del.*

FISH OF THE MALI HKA, U. BURMA.

Of the 32 species enumerated above, *Aoria* (*Macronoides*) *dayi*, *Homaloptera rupicola* and *Nemachilus paucifasciatus* are endemic in Burma, while the following are recorded for the first time from the Burmese waters:

Glyptothorax sinense, *Psilorhynchus balitora*, *Nemachilus kangjupkhulensis*, *Labeo* (*Labeo*) *dyocheilus* and *Barbus compressus*.

Of these 5 species, *Glyptothorax sinense* is a Chinese species, while *Psilorhynchus balitora*, *Nemachilus kangjupkhulensis* and *Labeo* (*Labeo*) *dyocheilus* (*s. str.*) have so far been found in North-eastern Bengal and Assam only. The species *Barbus compressus* has been doubtfully known from Kashmir from a single specimen and has not so far been rediscovered. Its occurrence in Burma is of special interest.

The rest of the species from the tributaries of the Mali river are widely distributed in the streams and rivers of India and Burma, and except for a variety of *Barbus clavatus*, which is described in this report as new, and appears to be an endemic form in Northern Burma, do not call for any special remarks.

All the specimens in Colonel Burton's collection are fairly well-preserved and most of the species are represented by a moderate number of specimens. Unfortunately, however, the method of tagging the specimens was faulty in that the fish have been tagged with wire passing right through the mouth. As a result, the jaws and the lips are in several cases badly damaged. As is well known, the characters of the mouth, the jaws and the lips are of great value in connection with the taxonomy of fishes, and proper care should, therefore, be taken by field-collectors in preserving and tagging the specimens. The easiest and the most suitable method of tagging is to pass the wire or the thread through the fleshy root of the tail.

In the systematic account of the different species of the Mali Hka fishes I have given detailed descriptions with additional notes and figures in such cases as have been found necessary. No attempt has been made to give lists of synonyms as most of the species are well-known and their synonymies are clear. Original and subsequent references have, however, so far as it was necessary, been cited. Under the caption of each species has been given a list of number of specimens represented in the collection together with their measurements, respective localities and Kachin names. I have made ample use of the field-notes of Colonel Burton which were received with the collection, and the local names of the different fishes and their weights etc. are as given in these notes.

In addition to the 32 species of fish from the Mali Hka system of which a list has been given above, the following genera and species have also been critically annotated or otherwise referred to in this report:

Amblyceps horae Prashad & Mukerji.
Glyptothorax conirostre (Steind.).
Glyptothorax botia (Ham. Buch.).
Glyptothorax dorsalis Vincig.

Glyptothorax burmanicus Prashad & Mukerji.
Parapseudecheneis Hora.
Parapseudecheneis paviei (Vaillant.).
Psilorhynchus McClelland.
Psilorhynchus sucatio (Ham. Buch.).
Chopraia Prashad & Mukerji.
Botia berdmorei (Blyth).
Botia nebulosa (Blyth).
Garra Hamilton Buchanan.
Discognathus Heckel.
Crossochilus latius punjabensis, subsp. nov.
Tor Gray.
Tor tor (Ham. Buch.).
Barbus clavatus McClelland.
Barbus spilopholus McClelland.
Rohtee Sykes.
Osteobrama Heckel.
Parosteobrama Tchang.
Parosteobrama pellegrini Tchang.
Rohtee vigorsii Sykes.
Rohtee duvaucelii (Cuv. & Val.).
Rohtee feae Vincig.
Rohtee alfrediana (Cuv. & Val.).
Rohtee cotio (Ham. Buch.)
Rohtee cumna (Tickell) Day.
Rohtee roeboides Myers.
Barbus nicholsi Myers.
Barbus nicholsi Vinciguerra.
Barbus vinciguerrae, nom. nov.
Barilius barnoides Vinciguerra.
Barilius ornatus Sauvage.
Danio browni Regan.
Ophicephalus Bloch.
Channa Scopoli.

I have to express my gratitude to Lt.-Col. R. B. Seymour Sewell and Dr. B. Prashad, the successive Directors of the Zoological Survey of India for kindly reading through the manuscript and making many valuable suggestions. To Dr. S. L. Hora I am greatly indebted for the facilities and help extended to me in the preparation of this report. The drawings illustrating the paper were executed under my supervision by Mr. R. C. Bagchi with care and precision, and for this my best thanks are due to him.

SYSTEMATIC DESCRIPTION.

FAMILY: SILURIDAE.

Silurus cochinchinensis Cuv. & Val.

One specimen (85 mm.) from Phungin Hka: '*Hkaram*'.

The maxillary barbels extend almost to the base of the ventrals. The mandibular barbels are about half as long as the head. The colouration is uniformly greyish, except for the head which is rather dusky. The maxillary barbels are black.

Callichrous bimaculatus (Bloch).

One specimen (118 mm.) from Phungin Hka: '*Buman*'.

The width of the head is almost equal to its length behind the middle of the eyes. The maxillary barbels reach the origin of the anal fin. The pectorals are almost as long as the length of the head behind the base of the maxillary barbels; its spine is as long as the head behind the posterior margin of the orbit.

The ground colouration of the body is dirty white with patches of dark brown to black spattered thickly all over. A faint dusky spot is present on the shoulder just behind the gill opening.

On examining a large series of *C. bimaculatus* from different places in India and Burma, I find that the species presents considerable variability, irrespective of locality and age, in regard to the colouration, lengths of the maxillary barbels and of the pectoral spines, and the depth of the body in relation to its length.

Aoria cavasius (Ham. Buch.).

One specimen (210 mm.) from Phungin Hka: '*Gawk Kyik*'.

The species is very variable, specially in regard to the lengths of the different barbels. In the specimen under report, as also in most Burmese individuals, the nasal barbels are shorter than the length of the head. In half-grown and young specimens the maxillary barbels do not as a rule extend beyond the anal fin, while in adults they reach the base of the caudal fin or even extend a little beyond it. Ordinarily, the outer mandibular barbels reach the tip of the pectorals, but they may, in some specimens, be much longer so as to meet the insertion of the ventrals. The inner mandibulars are almost invariably as long as the length of the head. The dorsal spine is shorter than the head and has minute serrations in the posterior upper third. The maxillary barbels are dusky above and whitish below. The characteristic black spot on the basal bone of the dorsal fin is present.

According to Day (14) the species attains "at least 18 inches in length". Colonel Burton has noted in his field-book that the fish grows "up to 20 lbs.".

Aoria (Macronoides) dayi (Vincig.).

One specimen (80 mm.) from Phungin Hka: '*Nbang Baw*'.
One specimen (78 mm.) from Tang Hka: '*Nga Hka*'.
One specimen (53 mm.) from Phungin Hka: '*Shing gyang*'.

The species was originally described and figured by Vinciguerra (53) from 'Meetan' and 'Toungoo' in Burma. In 1921, Hora (23) separated this species along with *Aoria affinis* (Blyth) and *A. merianiensis* (Chaudhuri) into a distinct sub-genus, *Macronoides*, which is characterised by "short barbels which do not exceed the length of the head, by possession of pores on the undersurface of the head and by the fact that the mandibular pairs of barbels are placed almost in a horizontal line". In 1929, the species was reported, for the second time from Burma, by Prashad and Mukerji (45) from the Indawgyi lake and rocky streams at Kamaing in the Myitkyina District. In the collections from the

Mali Hka system the fish is represented by three specimens as listed above. Unfortunately, they are not in a good state of preservation. I have, however, compared them with the other specimens of the species from the Myitkyina District and also with one of the type-series from 'Toungoo' kindly presented to the Indian Museum by Dr. D. Vinciguerra, and, so far as I can judge, all of them are referable to this species, although they have different Kachin names in the same and in different localities.

It appears that the number of serrations of the pectoral spines is variable. There are more serrations in the spines of the adults than in those of the half-grown and young individuals. The characteristic blackish patch at the free border of the dorsal fin and the one below its base are very faint. The body is clouded all over with fine brownish pigment.

FAMILY: AMBLYCEPIDAE.

Amblyceps mangois (Ham. Buch.).

One specimen (120 mm.) from Sinan Hka: '*Nga Yan*'.
One specimen (80 mm.) from Phungin Hka: '*Nga Yan*'.
One specimen (58 mm.) from Tang Hka: '*Uyan*'.

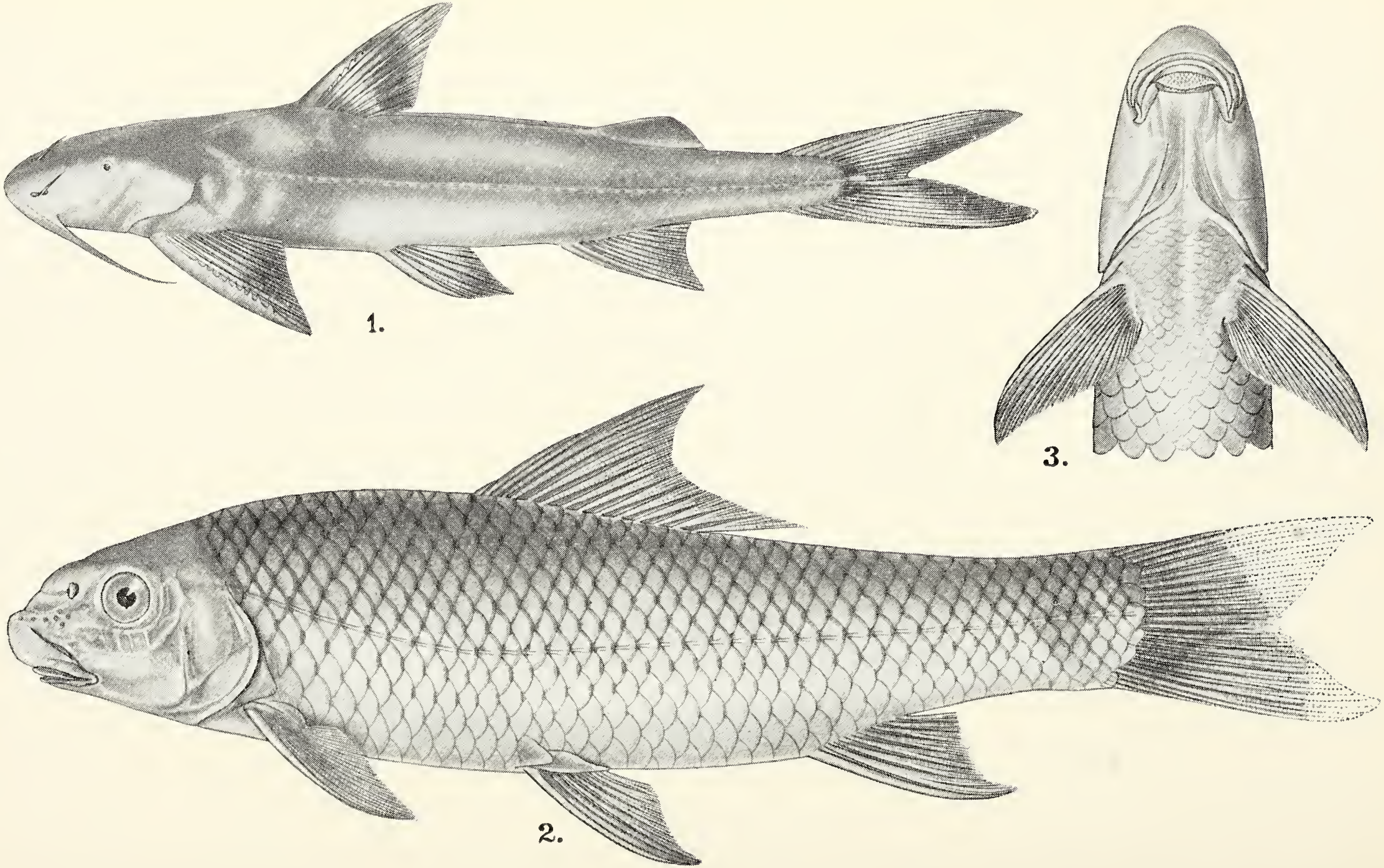
Among the Siluroid fishes that inhabit the hill-streams of India, Burma and elsewhere, there are few that can surpass *Amblyceps mangois* in the matter of its wide range of variability of the structure of the caudal fin, the length and the shape of the adipose dorsal and the nature of the jaws, etc. In fact, the differences between the two extreme forms of the species are often so very wide and well marked that nothing seems more contrary to the idea of natural species than to consider them conspecific; and this has been directly responsible for the creation of a number of so-called species under this genus.

Recently, both Dr. S. L. Hora and I have collected abundant material of *A. mangois* from the Sevoke stream in the Teesta valley at the base of the Darjiling Himalayas, which yields a series of intermediate forms and convincingly illustrates the perfect transition from one extreme form of the fish to the other. As Dr. Hora is making a thorough study of the structural peculiarities of the various divergent forms of *A. mangois*, and of its ecology and bionomics etc., I refrain from going into details.

The specimens from the Mali Hka system appear to be comparatively darker than usual. To my knowledge, the specimen from the Sinan Hka tributary is the largest (120 mm.) one of the species so far recorded.

Recently the range of distribution of *A. mangois* has been extended from India and Burma to Siam by Smith (50).

I take this opportunity to point out that through an unfortunate error, a new fish from the Myitkyina District of Upper Burma was described in 1929 by Prashad and Mukerji (45) as *Amblyceps horae*. On re-examination of the material it has been definitely ascertained that the species is referable to the genus *Olyra*. I am grateful to Dr. Hora for kindly drawing my attention to this point.



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FISH OF THE MALI HKA, U. BURMA.

FAMILY: SISORIDAE.

Glyptothorax sinense (Regan).

(Pl. II, Fig. 1).

One specimen (105 mm.) from Phungin Hka: '*Nga shari*'.

Regan (48) described the species from a single specimen, 65 mm. in total length and collected from Tungting in China. He remarked that "this is the first Chinese species of the genus". But, so far as I know, Steindachner's *G. conirostre* is the first species of the genus to have been discovered in that country, and it was taken from the "mountain streams running into the Min River, Sze Chuen" in China and reported by Günther in 1892.[1]

In the collection of fishes from the Mali Hka system in Northern Burma there is a single specimen which agrees in all essential details with *G. sinense*; but it shows certain minor variations in regard to the relative proportions of the depth of the body, and the length of the head, etc. For comparison with the type specimen of *G. sinense* which is preserved in the British Museum (Nat. Hist.), the present form from Burma was sent to Mr. J. R. Norman, who very kindly remarked: "I have compared the specimen of *Glyptothorax* from Burma with the type of *G. sinense* (Regan) and, as far as I can judge, it is the same species. The differences in the relative proportions of depth of body and length of head are almost certainly due to the difference in size of the two specimens".

In view of the fact that the original description of the species is short and based on a single half-grown specimen, a detailed description and figures of the Burmese specimen are given below:

D. 1/6; A. 2/9; P. 1/9; V. 1/5; C. 17.

The head is longer than broad and nearly twice as broad as deep. Its length is contained a little over 4 times and the maximum height of the body about 6 times in the length of the body excluding the caudal fin, which latter is slightly shorter than the length of the head.

The snout is rather broadly rounded anteriorly and is as long as the postorbital portion of the head. The eyes are small, superior and situated almost in the posterior half of the head. The orbital width is contained nearly 10 times in the length of the head. The interorbital space is convex and is 3 times the diameter of the orbit and half the distance between the nostrils.

The maxillary barbels are fairly broad at their bases and extend a little beyond the base of the pectoral fins. The outer mandibular barbels are half as long as the maxillaries, while the inner mandibulars are much shorter. The nasal barbels extend to the middle of the distance between their bases and the anterior margin of the eyes.

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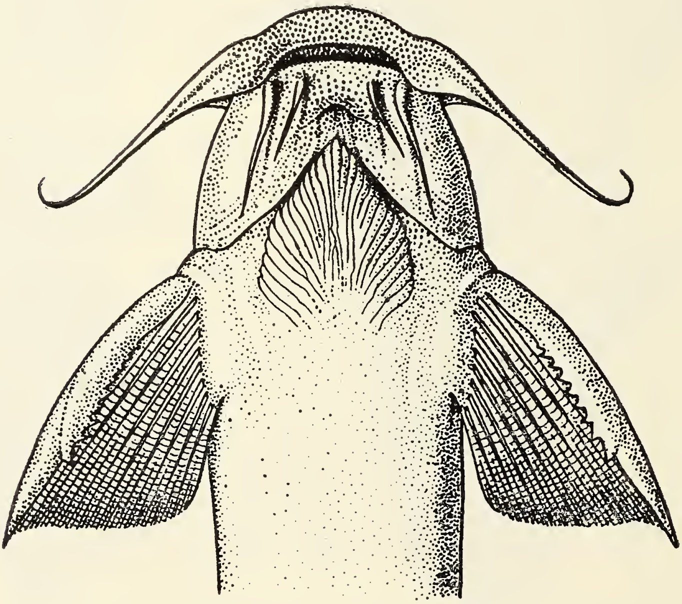
[1] In Pratt's *To the Snows of Tibet through China*, p. 245 (London, 1892).

The upper jaw is longer than the lower. The width of the gape of the mouth is almost equal to the length of the snout. The teeth are minute and sharp. In the upper jaw they are arranged in a single semi-lunar band, while in the lower jaw they are in two crescentic patches. The teeth of the mandible are longer than those of the maxilla. The lips are fairly well developed and more or less papillated. The adhesive structure on the chest (Text-fig. 1) is rhomboidal in shape and considerably longer than broad. It does not appear to have any definite depression in the centre. The anal opening is slightly nearer to the tip of the snout than to the base of the caudal.

The dorsal fin is inserted midway between the tip of the snout and the anterior margin of the base of the adipose dorsal. Its spine is very coarsely serrated, having 3 to 5 blunt denticulations on its posterior border. It is as long as the head behind the eyes. The longest ray of the dorsal is considerably longer than the greatest height of the body. The adipose dorsal is more or less triangular and about 3·5 times longer than high. Its base is nearly 2·5 times in the distance between its anterior end and the posterior margin of the base of the rayed dorsal. The pectorals are as long as the length of the head behind the nostrils. The spine is strong, dorso-ventrally flattened and has from 10 to 12 strong and sharp denticulations. The ventrals are inserted slightly behind the posterior end of the dorsal fin and are shorter than the pectorals. The anal fin is situated slightly in advance of the point of insertion of the soft dorsal. The paired fins are not plaited below.



Text-fig. 1.—Ventral view of anterior portion of body of *Glyptothorax sinense* (Regan) from the Mali Hka system, ×2.

The skin is more or less smooth except for a portion of the head which is finely tuberculate. The colouration of the specimen in alcohol is greenish brown with two faint and irregular darker patches, one below the rayed dorsal and the other below the adipose dorsal. The rayed dorsal has a broad, black longitudinal band in the middle.

Remarks: The tuberculate structure of the skin and certain other characters that the type-specimen from China has in common with *G. botia* (Ham. Buch.) induced Regan to place *G. sinense* nearest to *G. botia.* But from an examination of the larger specimen of the species from Northern Burma, in which the skin is more or less smooth, it appears to be more reasonable to consider *G. sinense* a closer ally of *G. dorsalis* Vinciguerra than of *G. botia.* In fact it is an intermediate form between *G. dorsalis* and *G. burmanicus* Prashad and Mukerji (45). The species is here recorded from Burma for the first time.

Measurements in millimetres.

Length of body without caudal	105.0
Height of body	18.0
Length of head	23.0
Breadth of head	18.0
Height of head	12.0
Length of snout	11.0
Diameter of eye	2.5
Interorbital width	7.0
Height of dorsal fin	16.0
Length of pectoral fin	22.5
Length of ventral fin	16.0
Length of anal fin	15.0
Length of caudal fin	21.0
Length of caudal peduncle	17.0
Least height of caudal peduncle	7.0

Pseudecheneis sulcatus (McClell.).

One specimen (110 mm.) from Sinan Hka: '*Nga hpai*'.

Until very recently the genus *Pseudecheneis* of Blyth embraced two species, *viz.*, *P. sulcatus* (McClell.) and *P. paviei* Vaillant. Of these two, *P. sulcatus*, the geno-type, is the only Indian species, having a range of distribution from the Darjiling Himalayas through the Abor Hills, the Khasi Hills, the Manipur Hills to Putao Plains (N.-E. Burma) and 'Catcin Cauri' in the neighbourhood of Bhamo, while *P. paviei* is a Chinese species obtained at Lai-chow in Tonkin. In a recent paper by Hora and Chabanaud (34) the former author, after having thoroughly examined the type-specimen of *P. paviei*, has rightly assigned the Chinese species to a new genus, *Parapseudecheneis*, while the latter has given an elaborate description of *Parapseudecheneis paviei* and compared in detail its differentiating characters with those of *P. sulcatus.* *Pseudecheneis* thus reverts to a monotypic genus.

The specimen from the Sinan Hka does not differ in any way from the examples of the species from different places in India and Burma preserved in the collection of the Indian Museum.

FAMILY: PSILORHYNCHIDAE.

GENUS **Psilorhynchus** McClelland.

There had been a certain amount of confusion regarding the validity and systematic position of the genus *Psilorhynchus* of McClelland and of the two Indian species, *P. sucatio* and *P. balitora*. The question of selection of the type—species has also been rather a difficult one, since McClelland himself did not select the type, and of the two species referred to the genus, *P. sucatio*, the first one in order of McClelland's descriptions, was not definitely known to any earlier author, excepting Hamilton Buchanan who is the author of both the species. Below I have reviewed the views of the different authors in order to clear up the whole matter.

In his *Gangetic Fishes* Hamilton Buchanan (20) described for the first time the two species under the denominations '*Cyprinus sucatio*' (p. 347) and '*Cyprinus balitora*' (p. 348) from the "rivers of Northern Bengal" and those "towards the north-east Bengal" respectively. In order of description of the different species of Buchanan's composite genus *Cyprinus*, *C. sucatio* and *C. balitora* occupy the 85th, *i.e.* the last but one, and the 86th, or the last positions respectively. In Buchanan's original manuscript notes of the *Gangetic Fishes* it is stated on page 225 that he procured '*Cyprinus sucatio*' or '*Stolephorus sucatio*'[1] from 'Baruni' on the '20th March 1809', while the next species '*Cyprinus balitora*' ('*Stolephorus*') which is described on page 226, was obtained from 'Gualpara' on the '10th of June 1808'. Among his unpublished drawings there are illustrations of these two species which were subsequently published by McClelland in the 19th volume of the *Asiatic Researches* (pl. i, figs. 1 & 2).

In 1839, in the *Asiatic Researches* (41) McClelland proposed the genus *Psilorhynchus* for Buchanan's *C. sucatio* and *C. balitora*. Unfortunately for the definition of his genus, as well as for the descriptions of the two species, McClelland had no examples of these species before him except a single one of *P. balitora* which he received from 'Upper Assam', and he, therefore, depended largely on Buchanan's descriptions and the manuscript drawings. His definition of the genus is thus very short and inadequate and the descriptions of the two species are even less diagnostic than those given by Buchanan. Throughout the account of the *Indian Cyprinidae* in the *Asiatic Researches* McClelland did not select any type for any of his genera described therein, and, likewise, no type was selected by him for *Psilorhynchus*. Like Buchanan he,

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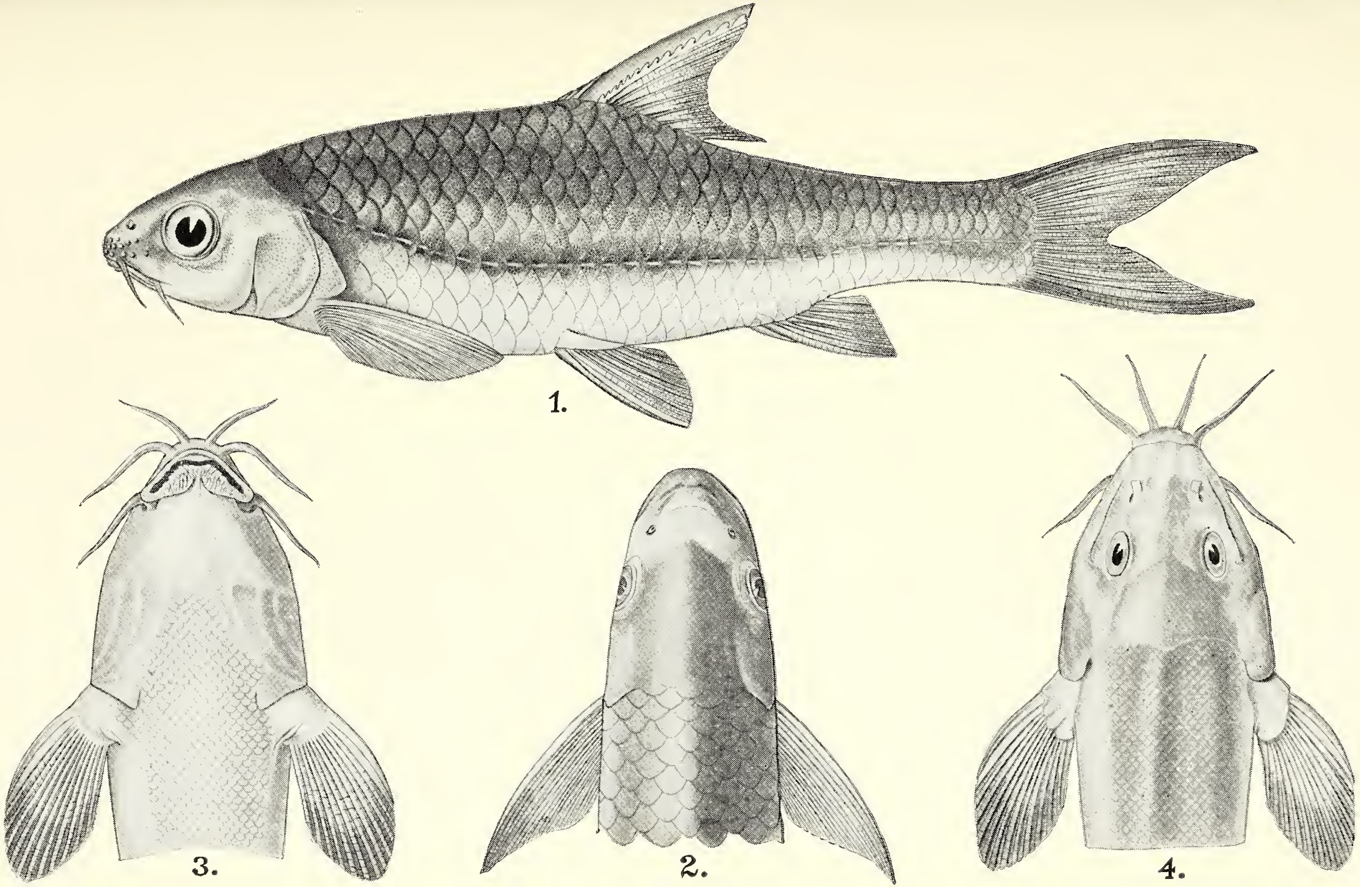
[1] In his manuscript notes Hamilton Buchanan first used the generic name '*Cyprinus*' for the two species and later the name '*Stolephorus*'; and although he labelled his unpublished drawings as *S. sucatio* and *S. balitora* he never published the name '*Stolephorus*'.



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however, gave *P. sucatio* the first place, but unnecessarily changed the name of the second species, *P. balitora* into *P. variegatus*, presumably in reference to the variegated colouration of the fish.

In 1868, Günther in his *Catalogue of Fishes* (19) as well as in his *Introduction to the study of fishes* (1880) recognised the genus *Psilorhynchus* and included it in the group Homalopterina with the remark: "I follow McClelland in associating the following genus with *Homaloptera*. Besides its general outward appearance, scarcely anything is known of its characters, and it is not impossible that future researches will assign to it another place in the system" (1868, p. 343). He, however, recognised both the species *P. sucatio* and *P. balitora* without further comment; but it appears that Günther did not examine any specimens of either of the two species.

In 1871, in his *Monograph of the Indian Cyprinidae* (11) Day assigned *Psilorhynchus* to the subfamily *Cyprininae* and published a more or less elaborate definition of the genus with the remark: "In removing this genus from the group of the *Homalopterinae* I must observe that I have only had opportunity of examining one of the two known species, the *P. balitora*, H. Buch. apud McClelland, and it does not appear at all impossible that the other, *P. sucatio*, H. Buch. may be destitute of an air-bladder and would thus form a distinct genus appertaining to the subfamily Homalopterinae". Thus Day also had no specimen of *P. sucatio* before him. He, accordingly, gave *P. balitora*, the known species, the first place in his descriptions (p. 106), and published a ventral view of the fish (pl. ix, fig. 1.).

In 1878, in his *Fishes of India* (14) Day maintained the genus *Psilorhynchus*, but recognised *P. balitora* as the only valid species. He remarked: "This genus, as illustrated by a single example described, is a connecting link between *Homaloptera* and *Discognathus*" (p. 527). He published a lateral (pl. cxxii, fig. 3) and a ventral view (pl. cxxi, fig. 7) of the fish. As for the other species, *P. sucatio*, Day doubtfully and wrongly relegated the form to the synonymy of *Homaloptera bilineata* Blyth[1] with the remark that the latter species "appears to be closely allied to Buchanan's fish from the rivers of Northern Bengal, which, however, is said to have the snout much longer than the remainder of the head" (p. 526).

In his *Fauna* volume (16) Day upheld the preceding views about the genus *Psilorhynchus* and the species *P. balitora*, but seems to have relinquished all doubts about *P. sucatio* being conspecific with *Homaloptera bilineata*. This can be clearly judged from his definite statement that *H. bilineata* is "found in Northern Bengal and the Tenasserim provinces" (p. 244). Day was fully aware of the fact that *H. bilineata* is restricted to "the Tenasserim provinces" of Lower Burma (1878, p. 526), and unless he considered *P. sucatio*, which occurs only in Northern Bengal, to be the same as

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[1] In its correct interpretation, *Homaloptera bilineata* Blyth is essentially an endemic form of Lower Burma (*vide*, Hora, S. L., 'Classification, Bionomics and Evolution of Homalopterid Fishes', *Mem. Ind. Mus.*, XII, No. 2, p. 288, 1932).

H. bilineata he would not have extended the range of the latter species to Northern Bengal.

In 1889, Vinciguerra (53) discussed the relationships of *P. sucatio* at some length and established that Buchanan's *Cyprinus sucatio* is not only not a synonym of *Homaloptera bilineata*, but it is not congeneric with it.

In 1919, Jordan in his *Genera of Fishes* (39) considered *Psilorhynchus* a synonym of *Homaloptera*, but selected *Cyprinus sucatio* of Buchanan as the logotype[1] of the former. In 1923, he (40) erroneously assigned the genus *Psilorhynchus* to the family Cobitidae.

In 1920, Hora (22) discussed the affinities of the genus *Psilorhynchus* at some length and pointed out that it is "abundantly distinct from the Homalopteridae"; and basing his arguments on the evidence then available to him, he referred *Psilorhynchus* to the family Cyprinidae and redefined it. But as he had only two old and rather deteriorated specimens of *P. balitora* before him and none of *P. sucatio*, his definition of the genus naturally remained to be further emended and the description of *P. balitora* to be greatly added to. He considered *P. balitora*, the only species known to him, as also to most of the earlier authors, to be the type-species of the genus *Psilorhynchus* (pp. 207-215). Subsequently, in 1921, he (25) published a detailed description (pp. 731-734) and excellent figures (pl. xxix, figs. 1 & 1a) of *P. sucatio* from three well-preserved specimens obtained from "the foot-hills of the Eastern Himalayas below Darjiling". In 1925, Hora (30) again referred to the question of the systematic position of *Psilorhynchus*, and ably discussed the views of the earlier authors. He definitely placed the genus in a distinct and well defined family which he called Psilorhynchidae. He remarked: "From the arrangement of the pharyngeal teeth and the presence of a number of simple rays in the paired fins it is clear that *Psilorhynchus* does not belong to the family Cyprinidae. The absence of barbels and the presence of a free bladder in the abdominal cavity separate it from the Homalopteridae. From the Cobitidae it is distinguished by the presence of large scales, by the presence of several simple rays in the horizontally placed paired fins, by the absence of barbels and its general facies" (pp. 459-460).

Recently, both Dr. S. L. Hora and I have collected abundant material of the species *P. sucatio* from pools and streams near Siliguri at the base of the Darjiling Himalayas and also a series of *P. balitora* from the Mahanaddi river at Siliguri and Sevoke stream in the Teesta valley. Messrs. G. E. Shaw and E. O. Shebbeare's collection of fishes from the different streams and rivers of northern Bengal has also considerably added to the number of examples of these species in the collection of the Indian Museum. I have thoroughly examined the extensive fresh materials of these two species, and I am fully convinced that both the species *P. balitora* and *P. sucatio* are congeneric and valid. I am in full agreement with Hora's views that *Psilorhynchus* should be referred to a distinct family for the reasons which he has already pointed out. Further, in skeletal preparations of the pelvic fins and girdle of the species *P. sucatio* and *P. balitora*, I find that, unlike any member of the family Cyprinidae as also that of the Cobitidae, the basipterygium of *Psilorhynchus* has undergone complete ossification so as to form a perfect shield-like structure, somewhat similar to that found in the family Homalopteridae, but differing from it chiefly in the absence of lateral horns and the lateral foramina. Instead of having lateral horns for the attachment of muscles, the basipterygium of *Psilorhynchus* has the lateral marginal portion of the osseous element on either side rolled upwards and inwards to form grooves.[1] (Text-fig. 2).

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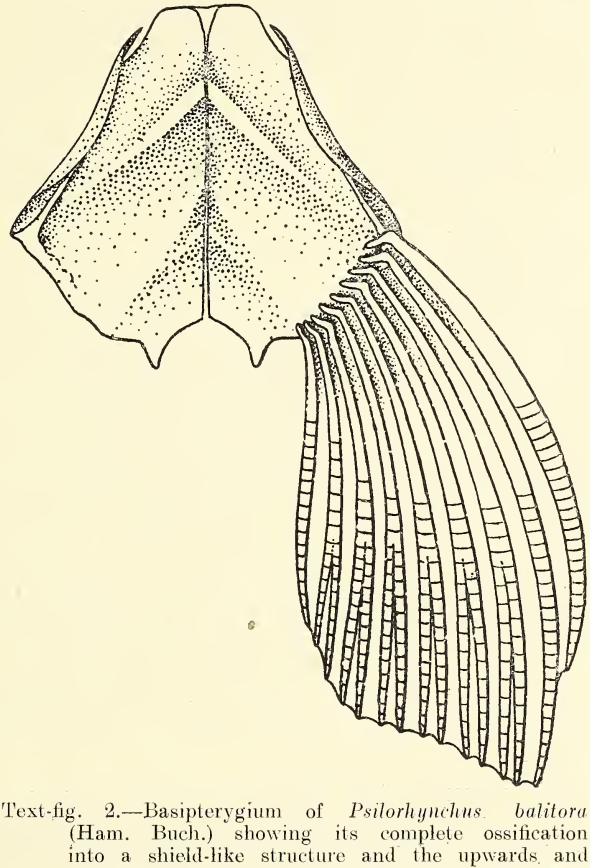
[1] According to Dr. D. S. Jordan, 'A *logotype* is one selected by the "first reviser".'



Text-fig. 2.—Basipterygium of *Psilorhynchus balitora* (Ham. Buch.) showing its complete ossification into a shield-like structure and the upwards and inwards rolling up of bones at the lateral margins, ×10.

With regard to the question of selection of the type-species of the genus *Psilorhynchus*, the final decision, yet to be arrived at, must be judged in the light of the two different selections by 'subsequent designation' made first by Jordan and later by Hora. In 1919, in his *Genera of Fishes*, Jordan designated *P. sucatio*, the first species in order of both Buchanan's and McClelland's descriptions, as the logotype of the genus, but as has already been mentioned above, he considered *Psilorhynchus* a synonym of *Homaloptera*, and later in 1923 referred it to the family Cobitidae. It is evident that the true identity of the genus *Psilorhynchus* and its systematic position were not definitely recognised and understood by Jordan, nor was the true status of the two species referred to the genus by McClelland critically studied by him. In selecting *P. sucatio* as the type of the genus he, therefore, simply adhered to the 'first species rule' (Recommendation '*s*' of the Rule '*g*' of Article 30 of the International Rules of the Zoological Nomenclature). Unfortunately, the selection of the first species as the type in this and in similar cases does not seem to be a happy one, for, it has to be admitted that though both *P. sucatio* and *P. balitora* are equally well-known now, in 1919 and till much later the species *P. sucatio* was known only from Buchanan's description and figure. *P. balitora,* on the contrary, was to most authors the better known of the two species, and McClelland, the author of the genus, actually examined a specimen of this species at the time he proposed the genus. This brings the case within the purview of the Recommendations '*n*' and '*g*' of the Rule of the Zoological Nomenclature mentioned above. According to these Recommendations, in selecting types by 'subsequent designation', preference is to be shown (i) to the 'best known' species and (ii) 'to a species which the author of the genus actually studied at or before the time he proposed the genus'.

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[1] Detailed studies on the modifications of the pelvic fins and girdles of the torrential fishes found in India and elsewhere are being carried on by me, and the results will be published later on.

In 1920, Hora, as already mentioned, examined a few specimens of *P. balitora* preserved in the collection of the Indian Museum, and, apparently unaware of Jordan's previous selection,[1] designated this species as the type of the genus *Psilorhynchus*. He did not assign any definite reasons for his selection of *P. balitora* as the type. It is presumable, however, that he adhered to the Recommendations '*n*' and '*q*'. But in view of the fact that there is no existing code of the Zoological Nomenclature that invalidates Jordan's first selection, unhappy though it was, and that both the species *P. sucatio* and *P. balitora* are equally well-known now, it seems, in my opinion, highly desirable to avoid confusion in future by accepting *P. sucatio* as the type of the genus.

The genus *Psilorhynchus* is represented in India so far by two species only, *viz*., *P. sucatio* and *P. balitora*. In 1920, Hora (22) published a description of a species of *Psilorhynchus* from a few immature specimen obtained by him in a hill-stream at Piphima in the Naga Hills in Assam. To him the species appeared to be new, but in view of the immaturity of the specimens he did not name the fish specifically. He, however, remarked: "the new species is readily distinguished from those previously known by its straight profile, by the absence of any grooves on the under surface of the head, and by the position of the eye, which is considerably nearer to the tip of the snout than to the posterior margin of the operculum'' (p. 732, 1921). I have very thoroughly examined these specimens from the Naga Hills, and on comparing them with series of young specimens of *P. balitora* from the Sevoke stream in the Teesta valley and from elsewhere, I find that they do not differ in any essential characters from *P. balitora* except for the position of the eyes which are situated slightly more anteriorly in the head. In the absence of any specimens of *P. balitora* of the same size, for comparison, it is not possible to arrive at any definite conclusion, but I am inclined to believe that the Assamese specimens represent immature stages of *P. balitora*, which is known to occur in Assam.

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[1] Dr. D. S. Jordan's *Genera of Fishes*, Part II was issued in July, 1919, while Dr. S. L. Hora's revision of the genus *Psilorhynchus* appeared early in 1920.

Of the two species, *P. sucatio* and *P. balitora*, the former has been, as already mentioned, properly defined and figured by Hora; and I have nothing to add, except as regards the number of its pharyngeal teeth. Hora has remarked: ''In the preparation of *P. sucatio*, one or two normal teeth are present and the remaining are of the nature of flat teeth with truncate crowns. The apex of such flat tooth is somewhat crenulated''. But my preparations of the pharyngeal bones and teeth of *P. sucatio* definitely show 4 teeth, which are looked at the tip and arranged in a single row (pl. I, fig. 5). It seems probable, therefore, that the structures being very minute and delicate, 2 of the 4 teeth might have dropped off or broken in Hora's preparation.

It has already been pointed out elsewhere that owing to the paucity of material of *P. balitora* in 1920, it was not possible for Hora to give a detailed description of the species in his revision of the genus. In recent years, however, large series of fresh material of *P. balitora* have accumulated in the collection of the Indian Museum; and I take this opportunity to give below a more or less detailed description of the species for reference in future. All the drawings of the fish so far published are rather inaccurate and poor for the purpose of determining the diagnostic features. Fresh figures of the different views of the fish are, therefore, supplied with the description.

Psilorhynchus balitora (Ham. Buch.).

(Pl. I, figs. 3 & 4.)

One specimen (48 mm.) from Phungin Hka: '*Hang-hka*'.
One specimen (56 mm.) from Tang Hka: '*Uhtang*'.

D. 3/9; A. 2/5; P. 6/10; V. 2/7; C. 17 (excluding the small compact outer rays); L. 1. 32-34; L. tr. 6 ($3\frac{1}{2}/2\frac{1}{2}$).

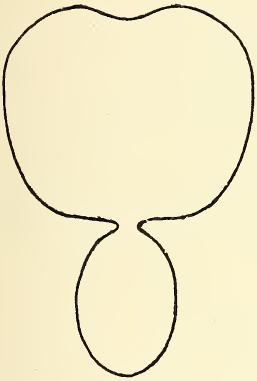
In its general facies the species has a very close resemblance to a Homalopterid fish. The dorsal profile rises from the tip of the snout, forms a slightly concave margin between it and the anterior edge of the orbit, and then slowly rises to the insertion of the dorsal fin. Beyond the commencement of the dorsal fin the outline slopes down gradually to the root of the caudal fin. The ventral profile is more or less horizontal or very slightly convex. The under-surface of the head and the chest region are flat and horizontal like those of the Homalopterid fishes of fast currents.

The head is rather small and conical. Its length is almost equal to or a little less than the maximum depth of the body below the dorsal fin, and is contained from 4.4 to about 5.3 times in the length of the body without the caudal fin. It is slightly broader than it is high. The snout is flat and obtusely pointed anteriorly, and its length is contained from 2 to nearly 2·5 times in the length of the head. There is a shallow depression across it in front of the eyes. In grown-up individuals, and specially in males, there are minute horny and pointed tubercles on the snout and on the cheeks. The eyes are large and situated almost entirely in the posterior half of the head. They are placed high in the head and are, therefore, scarcely visible from the ventral surface. In adult individuals the diameter of the eyes is contained nearly 3 times in the length of the head, while in young specimens, the eyes being comparatively large, the proportion of the diameter is about 2.5 times. The interorbital region is almost flat or very slightly concave. It is not so wide as the orbit. The gill openings are narrow. They extend from the anteriormost point of the lateral line down to a point in front of the ventral base of the pectoral fins, and vertically below the posterior margin of the orbit. The external nostrils are more or less large and are situated much nearer the anterior margin of the eyes than the tip of the snout.

The mouth is sub-ventral and its narrow opening is more or less transverse. The upper jaw overhangs the vestibulum of the mouth. Both the upper and the lower jaws are provided with sharp cutting horny edges, which suggest the fish's habit of scraping and rasping off food from the rocky bed of the streams it inhabits. The lips are moderately fleshy and continuous. The lower lip is capable of being everted out from the jaw. Minute post-labial fold-like structures are present at the angles of the lips. A distinct lateral groove passes on either side from the post-labial groove to the sides of the snout. Just behind and below the lower lip is a shallow depression, beset with minute papillae which probably acts as an accessary means of attachment.

The dorsal fin is inserted in advance of the ventrals and is situated much nearer the tip of the snout than the root of the caudal fin. It is almost as high as the depth of the body below it, and its outer margin is more or less straight and oblique. The pectoral fins are horizontally placed and are longer than the head: they have a somewhat rounded outer margin and they do not reach the ventrals. The ventrals are similarly situated and have a similar shape but are shorter than the pectorals: they are separated from the insertion of the anal by a considerable distance. The anal fin is rather short and has a straight outer margin: when laid flat it almost reaches the root of the caudal fin. The caudal fin is considerably longer than the head and its own height: it is bilobed, the upper lobe in most cases being longer than the lower.

The lateral line is straight and runs to the middle of the base of the caudal fin. The scales are fairly large and arranged regularly on the body. There are 10 scales before the dorsal fin and 10 to 12 round the caudal peduncle. The anterior portion of the chest is devoid of scales, while the portion confined between the bases of the pectorals is covered with reduced scales. The anal opening is situated between the middle of the ventral fins.


Text-fig. 3.—Air-bladder of *Psilorhynchus balitora* (Ham. Buch.), ×12.

The air-bladder (Text-fig. 3) is, as already described by Hora (22), generally very much reduced but is more or less of the Cyprinid type. In most cases the larger anterior chamber is partly or wholly covered with a thick fibrous tissue. The pharyngeal bones and the teeth are very minute and slender. On each side of the pharyngeal bones there are 4 slender and more or less hooked teeth arranged in a single row like those of *P. sucatio.*

I have noted the colouration of the fish in its natural habitat and have found that it is very variable. The young specimens are more gorgeously coloured, having a very bright silvery ground with 6 to 8 shining dark patches on the dorsum and along the sides. In grown-up specimens these patches become somewhat diffused and the fish has a more or less uniform blackish-blue to brownish ground colour with irregular white patches here and there. The under surface is silvery. All the fins are diaphanous excepting the dorsal and the caudal fins. The dorsal has generally a blackish band towards the free margin, while the caudal has invariably two similar vertical bands. In some adult individuals these bands break up into irregular blackish patches.

Remarks: *P. balitora* is found in the fast streams and shallow rivers of Northern Bengal and Assam, specially where the bottom is rocky. I have never found the fish living in any sluggish stream with a muddy bottom. In the Sevoke stream and in the shallow, clear and rocky parts of the Mahanaddi river, I have observed series of *P. balitora* adhering tightly to the rocky substratum with the expanded paired fins and the chest applied to the rocks. Like other torrential fishes, it always points its head against the flow of the current. The variegated colouration of the fish harmonises so perfectly with the surroundings that it is hard to detect its presence even from a short distance. The species is here recorded from Burma for the first time.

Measurements in millimetres:

	Mali Hka System			Northern Bengal		
Length of body without caudal.	56·0	48·0	54·0	29·0	24·0	22·0
Height of body	12·0	10·0	13·0	6·0	5·0	5·0
Length of head	12·0	9·0	11·0	6·0	5·0	5·0
Breadth of head	9·0	8·0	9·0	5·5	4·0	4·0
Height of head	8·0	7·0	8·0	4·5	3·5	3·5
Length of snout	5·0	4·0	4·0	3·0	2·0	2·0
Diameter of eye	4·0	3·0	3·5	2·5	2·0	2·0
Interorbital width	3·0	2·5	2·5	1·5	1·5	1·0
Height of dorsal fin ...	11·5	10·0	11·5	6·5	6·0	5·0
Length of pectoral fin ...	14·0	12·0	12·5	7·5	7·0	7·0
Length of ventral fin ...	11·5	9·5	11·0	5·5	5·0	5·0
Length of anal fin	8·5	7·0	8·0	5·0	4·0	3·5
Length of caudal fin ...	12·5	11·0	12·5	8·0	7·0	5·0
Length of caudal peduncle ...	6·0	5·0	6·0	4·0	3·0	3·0
Least height of caudal peduncle	5·5	4·0	5·0	2·5	2·0	1·75

EXPLANATION OF PLATE I.

Fig. 1.—Lateral view of *Nemachilus botia* (Ham. Buch.) from the Mali Hka system, ×1¼.

Fig. 2.—Lateral view of *Psilorhynchus balitora* (Ham. Buch.) from the Mali Hka system, ×1¼.

Fig. 3.—Ventral view of the anterior portion of the body of the same, ×2.

Fig. 4.—Dorsal view of the same, ×2.

Fig. 5.—Pharyngeal bone and the teeth of *Psilorhynchus sucatio* (Ham. Buch.), ×30.

Fig. 6.—Lateral view of *Barbus compressus* Day from the Mali Hka system, *ca* Nat. size.

EXPLANATION OF PLATE II.

Fig. 1.—Lateral view of *Glyptothorax sinense* (Regan) from the Mali Hka system, *ca.* Nat. size.

Fig. 2.—Lateral view of *Labeo* (*Labeo*) *dyocheilus* (McClell.) from the Mali Hka system, ×⅔.

Fig. 3.—Ventral view of the anterior portion of the body of the same, ×⅔.

EXPLANATION OF PLATE III.

Fig. 1.—Lateral view of the type specimen of *Barbus clavatus burtoni*, subsp. nov. from the Mali Hka system, *ca* Nat. size.

Fig. 2.—Dorsal view of the anterior portion of the body of *Labeo* (*Labeo*) *dyocheilus* (McClell.) from the Mali Hka system, × ⅔.

Fig. 3.—Ventral view of the anterior portion of the body of *Nemachilus botia* (Ham. Buch.) from the Mali Hka system, ×*ca* 1½.

Fig. 4.—Dorsal view of the same. ×*ca* 1½.

(*To be continued*).

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS (ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., assisted by N. B. KINNEAR, M.B.O.U.

PART VI.

(*Continued from page* 590 *of volume* xxxvi).

Ploceus philippinus philippinus (Linn).

Loxia philippina Linn. Syst. Nat. ed. xii, vol. i (1766), p. 305—Philippines *errore*—Ceylon.

Specimens collected.—26 ♀ 28 ♂ 11-4-29, 150 ♂ 28-4-29, 166-168 ♂♀♀ 1-5-29 Kurumbapatti; 491-492 ♂♂ 3-7-29, 519-521 ♂♂♂ 6-7-29 Kalai, Trichinopoly; 1122 ♀ 1124 ♂ 16-12-29, 1127 [♀] 17-12-29, 1170-1171 ♂♂ 1178 [♀] 25-12-29, 1174 ♀ 1176 ♂ juv. 26-12-29 Cumbum valley.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
11 ♂	17.5-18.5	70-76.5	44-52	19.5-22 mm.
7 ♀	17.5-18.5	67-71	42-47	20-22 mm.

We have not got a great deal of information about the Common Baya Weaver in the Presidency and I cannot in fact trace any record of it in the area to the north of the Godavery river. South of that, the Survey found it common in the Cumbum valley, at Kurumbapatti and at Kalai, Trichinopoly. At Kurumbapatti, Mr. LaPersonne tells us that they were going about in April in flocks of 20-30 birds and they were still in flocks on the 6th May. Although the males obtained there are in winter plumage their testes had started to enlarge by 11 April. The Kalai specimens were in full breeding plumage but the Cumbum valley series were again in winter dress. This weaver seems fairly common also in the neighbourhood of Madras Town.

On the eastern side, there is but little information. William Davison says it occurs throughout the Wynaad. Colonel Sparrow has shown me specimens obtained at Malappuram, S. Malabar in July (breeding plumage) and December. In Travancore, Ferguson and Bourdillon say that it is common in the low country but does not ascend the hills. There they give the breeding season as from May to August. Captain Bates informs me that at Madras he considered the breeding season to be in the North-East Monsoon, commencing about September. In his last year there, however, he found a colony building in May after an abnormal downpour of rain, and a number of colonies hard at work in July.

I cannot avoid the conclusion that *Ploceus philippinus* and *Ploceus passerinus* (of the *New Fauna*, vol. iii, pp. 67 and 70) are merely races of the same species. After a careful examination of all available specimens and records I find no reason to believe that *philippinus* and *passerinus* ever breed in the same area. They certainly intergrade with each other in Nepal (cf. Scully, S.F., viii, 332) and about the Chota Nagpur area; and though Stanford (J.B.N.H.S., xxxiv, 910) apparently considered that his specimens of *philippinus*, shot in February in winter-dress in the Prome district, represented the local breeding colonies of Bayas, proof is lacking and I feel sure that it is much more probable that they were winter visitors from India. Ticehurst has shown that the name *passerinus* cannot stand nor can Mr. Stuart-Baker's further emendation (vol. viii, p. 651) of it to *Ploceus atrigula*. Birds from the East Himalaya area agree with those of northern Burma and they should in future therefore bear the name *P. philippinus burmanicus* Ticehurst (Bull. B.O.C., vol. lii, no. ccclvii, March 1932, p. 104—Akyab.)

Ploceus megarhynchus Hume still remains somewhat of a mystery. Hume at first (see S.F., 153) was inclined to group under this name not only his original birds but also certain specimens of *passerinus* [=*burmanicus*]. However in *Stray Feathers*, vol. vi, p. 400 he realises that the two original specimens remain unique. I have carefully examined them. They are two females or males in winter plumage, shot in December 1866 near Kaladoongee below Naina Tal. They are both just completing an entire moult, the wing feathers still showing traces of the sheath at their base. In colour they would pass as *philippinus*. In size they are immense:—bill from skull 21·5 (type) and 22; wing, 77 and 80·5; tail, 56 and 59 mm. I cannot match these measurements in a large series of *philippinus* and *burmanicus* and I am not able to accept the suggestion (*New Fauna*, iii, p. 70) that *megarhynchus* breeds in the Duars. All specimens thence in the British Museum, as well as others collected by Mr. H. V. O'Donel and Mr. Inglis and given or loaned to me, belong beyond dispute to *burmanicus*. The series of skins presented to the Bombay Natural History Society can no longer be traced in their collection.

If Finn (Ibis, 1901, p. 29) was right in considering his cage-birds as examples of *megarhynchus* in breeding dress it must be a very distinct species.

Ploceus manyar flaviceps Lesson.

Ploceus flaviceps Lesson, Traité d'Orn. (1831), p. 435 ex Cuvier MS.—Pondicherry.

We can only trace two localities for the Streaked Weaver-bird in the Presidency, namely the type locality Pondicherry (where it was collected by Leschenault) and the Vellarney Lake, a few miles out of Trivandrum (Travancore). From this latter locality there are in the British Museum an adult male and a juvenile collected on 21 June 1877 by Bourdillon. He tells us (S.F., vii, p. 39) that on that date he found thousands just beginning to build amongst the reeds which formed floating islands on the lake.

[**Munia oryzivora** (Linnaeus).

Loxia oryzivora Linn., Syst. Nat. ed. xii, vol. i (1766), p. 302—Asia=Java.

The Java Sparrow is stated by Oates (*Old Fauna*, vol. ii, p. 182, footnote) to be 'now met with in the wild state in Madras' as an introduced species. I have found no further information on the point and do not know whether it is still to be found wild in the Presidency.]

Munia malacca (Linnaeus).

Loxia malacca Linn., Syst. Nat. ed. xii, vol. i (1776), p. 302—China, Java and Malacca *errore*—Belgaum.

Not procured by the Survey. The exact distribution of the Black-headed Munia in the Presidency is not very accurately known. Colonel Sparrow obtained specimens at the Kolair Lake on 1st February 1913 and there is a series of 8 specimens from Madras in March in the British Museum.

On the western side William Davison met with it on two or three occasions in the Wynaad. A. G. R. Theobald's account of the breeding at Pothanore, in the Coimbatore district, is given in Hume's *Nests and Eggs* and one of his skins from this locality is in the British Museum. Terry found it fairly common in the Lower Palnis, breeding in the Pittur valley. In Travancore it is only found in the low country where it is common, especially about the backwaters. Bourdillon has given us an account of a breeding colony in the Vellarnay Lake near Trivandrum (S.F., vii, 39). This munia seems very definitey addicted to swampy ground and the neighbourhood of water.

Within our limits the breeding season is variously given as latter half of October (Pathanore), April (Pittur valley) and May to August (Travancore).

Mr. Stuart Baker recognises two races of this Black-headed munia in Southern India, *malacca* and *orientalis*, though his account of their distribution is far from clear and certainly includes very large areas where the species has not been recorded. I have been able to assemble a small series, supplementary to the British Museum, and am of opinion that the race *orientalis* cannot be upheld. The differences given for it depend on wear of plumage and make of skin. I think it is, moreover, highly probable that *Munia atripapilla* should properly be itself considered a race of *Munia malacca*.

There is some confusion over Mr. Stuart Baker's restrictions of the type locality of this species. In his Handlist (p. 97) he restricted it to Malacca where it does not occur. Then in the *New Fauna*, vol. iii, he has restricted it successively to Belgaum and Ceylon on the same page (78). The first of the possible restrictions must stand.

Uroloncha striata striata (Linn).

Loxia striata Linnaeus, Syst. Nat. ed. xii (1766), p. 306—Isle of Bourbon *errore*—Ceylon.

Specimens collected:—329, 330, 332 ♂♂♂ 5-6-29, 359 ♂ 361 o? 7-6-29 Chitteri range 2,000 ft.; 1353 ♂ 8-2-30 Anantagiri 3,000 ft.; 1505-1507 ♂♂♂ 9-3-30, 1656 o? 4-4-30, Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	12.5-13.5	52-55.5	39-42	13-14 mm.

The White-backed Munia appears to be fairly common and very generally distributed in the Presidency. Jerdon tells us that it occurs sparingly in the Northern Circars but in the Vizagapatam District LaPersonne found it common at Anantagiri and at Sankrametta 'chiefly on the bazaar grounds after *shandy* (market) day'.

Dewar considered it not common at Madras. LaPersonne saw it about at Kurumbapatti in April. Here however he specially records that they had apparently left the neighbourhood by the end of the month and it is possible that the bird is a partial migrant between the hills and plains as it was common in June in the Chitteri range and Hume received the nest from Yercaud.

On the western side Betts found it a common resident in Coorg. It breeds commonly in the Wynaad and in the Nilgiris. Betts informs me that it is a common resident at 3,500 ft. in the Ochterlony valley. It occurs higher than this and at Kotagherry, Miss Cockburn considered it not numerous, shy and a migrant for breeding only.

It is an abundant and familiar species on the Malabar coast, according to Jerdon, seen constantly on the roadside, about houses and in stable yards, gathering also into vast flocks that feed in the rice fields.

Terry found a flock in the Pittur valley of the Palni Hills. In Travancore, it is common, occurring up to 2,500 ft. (Ferguson).

This munia probably breeds chiefly in the rains as, both in Coorg and the Nilgiris, it breeds in July and Hume's nest from Yercaud contained 6 eggs on 28 September. In the Wynaad, however, Mr. J. Darling Jnr. found nests from April to June and also in November and December.

The Survey series from the Chitteri range and birds from South India generally cannot be distinguished from a series from Ceylon. The Vizagapatam series however differ from them as follows:—the upper parts are browner, less black with more marked shaft streaks; the shorter upper tail coverts agree with the back in colour and contrast with the longer tail coverts which are black; the ear-coverts and sides of the neck are browner; and finally the flanks show traces of fine black squamations. In other words these specimens show passage towards the special characteristics of the sub-Himalayan race *U. s. acuticauda*. Beavan's specimens from Manubhum agree with them and these intermediate characters are found in a greater or less degree in other specimens in the British Museum from the eastern Central Provinces. Until the distribution is known in better detail, however, we think no useful purpose will be served by the naming of an intermediate race.

The present series of skins shows that this species undergoes a complete moult between March and July.

Uroloncha kelaarti jerdoni (Hume).

Munia jerdoni Hume, *Nests and Eggs Ind. Birds,* Pt. ii (1873), p. 448—Wynaad.

The Rufous-bellied Munia has hitherto been only known from the hills of South-Western India from Coorg to Travancore, unless evidence is to be attached to the statement that Mr. Laird procured it in the jungles W.

of Belgaum (S.F., ix, 415). It is common in Coorg, the Wynaad, the Nilgiris (breeding up to 4,500 ft. and straying up to the plateau), the Palnis and the whole of the Travancore ranges. About Kotagherry Miss Cockburn considered the species a breeding visitor only but its migrations must be necessarily very limited.

The breeding season is said to be from July to September in the Nilgiris and March to July in Travancore (Stuart Baker).

It is unfortunate that the well-known name of *Amadina pectoralis* Blyth cannot be used for this species but it is preoccupied by *Amadina pectoralis* Gould, if both birds are to be placed in the same genus which seems desirable. I do not in any case see how one can avoid the conclusion that it is a subspecies of *Munia kelaarti* Jerdon, *Birds of India,* vol. ii (1863), p. 356—Ceylon. The plumage of both birds contain the same characteristics, varying only in their degree of development. *Jerdoni* differs from *kelaarti* in the adult summer plumage as follows:—the rump is similar to the back, the upper tail coverts less black, more approaching the colour of the rump, the cruciform markings pinkish and nearly obsolete; the lower parts below the black gular patch are pale pinkish buff with pale shaft streaks, the cruciform markings confined to a small area on the vent; the lower tail coverts have the cruciform markings replaced by pinkish buff shaft streaks.

The so-called immature plumage differs from the corresponding stage of *kelaarti* in that the chin and throat lack the black and white spangles and resemble the remainder of the lower plumage, which lacks the dark broken cross-barring of *kelaarti.*

Uroloncha kelaarti vernayi subsp. nov.

Specimens collected:—1558 ♀, 1560-1561 ♂♂ 17-3-30 Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	13-13.5	57-59	37-39	14-15 mm.
1 ♀	13	59	39	14 mm.

These three birds killed on the same date and presumably from the same flock are all in the so-called immature plumage, but no. 1560 is in body moult which is sufficiently advanced to show that all three specimens belong to the *kelaarti* group, in which they are very close to *jerdoni.* They differ from the corresponding stage of *jerdoni*, however, in the following details; the upper plumage is much paler, earth-brown as opposed to chocolate brown; the lower plumage is very much paler, greyish brown on the breast, greyish white elsewhere, faintly tinged with pink as opposed to (in *jerdoni*) buffy brown on the breast, buffish white elsewhere, the whole suffused with warm fulvous. In no. 1560 the adult feathers that have moulted through show that the lower parts will be a much paler more pearly pink than in *jerdoni.*

It is evident that these specimens represent another of the peculiar Vizagapatam ghat forms, and the extension of the range of this South Indian species is most interesting.

We have much pleasure in naming the novelty after Mr. A. S. Vernay.

Type no. 1558 ♀ 17-3-30 Sankrametta 3,500 ft. Deposited in the British Museum.

Uroloncha malabarica (Linn).

Loxia malabarica Linnaeus, Syst. Nat. ed. x, vol. i (January 1758), p. 175—India, Malabar Coast.

Specimens collected:—471 ♀ 23-6-29 Tirthamalai 1,000 ft.; 487 ♀ 2-7-29 Trichinopoly; 524-525 ♂♀ 6-7-29 Kalai; 570 ♀ 21-7-29 Gingee; 766-767 ♀♂ 27-8-29 Palkonda Hills 500 ft.; 778-779 ♀♂ 31-8-29, 795 ♀ 10-9-29 Kodur 500 ft.; 883 ♂ 6-10-29 Seschachalam Hills 2,000 ft.; 1121, 1123, 1125 ♂♂♂ 16-12-29, 1172 ♂ 25-12-29 Cumbum valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	10-11	53.5-57	45-52.5	13-14 mm.
7 ♀	10.5-11	53-56	44.5-49	13-14 mm.

I can trace no record of the White-throated Munia in that part of the Presidency which lies to the north of the Godavery. South of that river, however, it appears to be common and very generally distributed from sea level up to 2,000 ft., at least in the Seschachalam Hills, all down the eastern side as far as Cape Comorin. It is essentially a bird of dry open country and it therefore is absent from the western side of the Presidency. Bulger's statement (P.Z.S. 1866, p. 571) that it is tolerably common in the Nilgiris appears to be mistaken; at least no one else has recorded it there.

In Travancore, where it only occurs about Cape Comorin, Ferguson says that the breeding season is from December to March.

In spite of its wide distribution the White-throated Munia cannot be separated into races.

Uroloncha punctulata lineoventer (Hodgson).

Munia lineoventer Hodgson, As. Res., xix, pt. i (October 1836), p. 154—Nepal.

Specimens collected:—513-514 ♂ ♀ 5-7-29 Kalai, Trichinopoly; 734 ♀ 23-8-29 Palkonda Hills 1,000 ft.; 777 ♂ 31-9-29 Kodur 500 ft.; 994 ♀ 11-11-29 Nallamallai range 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	12.5-13	56-57	39-40.5	14.5-15 mm.
3 ♀	12-13	54.5-56	39-40.5	13.5-14.5 mm.

There is at present no record of the Spotted Munia in the Presidency from the area north of the Godavery, but south of that river it is probably very generally distributed. In addition to the localities supplied by the Survey specimens and Jerdon's statement that it is found in various parts of the Carnatic, Dewar tells us that it is found occasionally at Madras. Theobald's account of the breeding habits at Sooramungulam, in Salem (N. and E., 2nd ed. vol. ii, p. 144) implies that the bird is common in that district. Ferguson says that it is common in the low country of Travancore and Colonel Sparrow has lent me specimens collected at Malappuram. How far it occurs in the hill ranges of the west is not very clear.

Ferguson says that it does not ascend the Travancore ranges and, in the Palnis, Fairbank only met with it twice in the lower hills. In the Nilgiris, on the other hand, it is common, being abundant round Ootacamund, and in these hills, according to Miss Cockburn, it is a migrant from the lower country arriving in June, breeding and remaining till the end of October. Otherwise she noted occasional birds in December in flocks of Avadavats.

The breeding season at Coonoor, according to Mr. Wait, is any time between February and September, most eggs being laid in April and May. This hardly agrees with Miss Cockburn's statement, confirmed to me also by Mr. Betts, that the bird is a migrant and she gives the breeding season as July and August. At Sooramungulam Theobald also says that it breeds in August but in Travancore Ferguson says it breeds from April to July.

Stictospiza formosa (Latham).

Fringilla formosa Latham, Index Ornith., vol i (1790), p. 441—India.

Specimens collected:—1495-1497 o?♂ ♀ 8-3-30, 1572-1573 ♀♂ 20-3-30, 1591 ♀ 24-3-30 Sankrametta 3,000 ft.; 1687-1688 ♂ ♀ Jeypore Agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	10.5-11.5	48-49	37-38.5	13.5-14.5 mm.
4 ♀	10-11	46-49.5	34.5-39	13-14.5 mm.

LaPersonne writes:—This handome bird was common at Sankrametta 3,000 ft., frequenting open boulder strewn scrub jungle. They were not shy and would allow a close approach while feeding. There was no genital development.

These specimens afford the first record of the Green Munia for the Presidency though Mr. D'Abreu informs me that it occurs at Bhanpur in Bastar

State which is not far distant. The *New Fauna* gives Jhansi as the northern limit of distribution, but, although the breeding records for Lahore (Currie, J.B.N.H.S. xxiv, 594) may perhaps be attributed to escapes, there is no reason for not accepting the statement that the Green Munia is an uncommon resident in the Lucknow division (Reid S.F. x. 56). There are no races. This genus seems hardly worth separation from *Amandava*.

The original drawing from which Latham took his description is in the British Museum. It was made for a Mrs. Wheeler, a resident in Calcutta and was doubtless painted from a cage-bird as the Green Munia does not occur at Calcutta.

Amandava amandava amandava Linnaeus.

Fringilla amandava Linn., Syst. Nat. ed. x, vol. i (1758), p. 180—India orientalis, now restricted to Northern Guzerat.[1]

Not obtained by the Survey. In both editions of the *Fauna* the Red Avadavat is said to occur throughout India. It may be as well therefore to emphasise the fact that in addition to Jerdon's statement that it occurs here and there throughout the Carnatic I can only trace records for two areas in the Presidency. It is common in the Nilgiris ascending to 6,000 ft. and breeding apparently any time from May to December.

Terry records a large flock at Pulungi in April (S.F. x. 478).

The *New Fauna* has failed to mention the fact (pointed out by Ticehurst Ibis 1922, pp. 646-7) that the male of this munia assumes the well-known red plumage merely as a breeding dress, reverting in the non-breeding season to a brown plumage similar to that of the female. I suspect that this is the case in several other species e.g. *Stictospiza formosa* though as yet I have not sufficient material to prove it beyond doubt. The point may be commedned to workers in the field.

The Burmese Red Avadavat (*Amandava flavidiventris* Wallace) is certainly a race of this species.

Carpodacus erythrinus roseatus (Blyth). [2]

Erythrospiza roseata Blyth J.A.S.B., 1842 p. 461—Calcutta.

Specimens collected:—171-172 ♀♂ 2-5-29 Kurumbapatti; 1462-1463 ♂o? 3-3-30, 1474 ♀ 5-3-30, 1481-1482 ♀♂ 1488 ♂ 6-3-30, 1508 ♂ 9-3-30, 1514 ♀ 10-3-30, 1518 ♀ 11-3-30, 1528 ♀ 12-3-30, 1530 ♀ 1533 ♂ 13-3-30, 1548 ♂ 15-3-30, 1555-1556 ♂♂ 17-3-30, 1700 ♂ 30-3-30 Sankrametta 3,500-3,800 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
6 adult ♂	14-15	84.5-87.5	57.5-60.5	17.5-19.5 mm.
4 imm. ♂	13.5-15	82-88	55.5-59.5	17-19.5 mm.
7 ♀	14-15	81-85	51.5-60	18.5-19 mm.

The Survey found the Common Rose Finch at Sankrametta in extremely large flocks on migration during the month of March. By the middle of April their numbers decreased considerably and by May none were seen. All the specimens procured were very fat. It was otherwise only procured at Kurumbapatti on 2nd May when a pair, also extremely fat, were shot feeding off the figs of a Banyan tree. In none of these birds had the organs started to enlarge.

These are the only records we have traced for the eastern side of the Presidency. On the west it is well-known as a late winter visitor. In Coorg Betts states that a Rose Finch evidently this—is a somewhat uncommon winter visitor in large flocks, first noted on 22 November. William Davison tells us that it is found all over the Wynaad and extreme Southern Mysore, but is particularly numerous on the Nilgiris. Here it is always in flocks which feed in gardens and cultivation and are somewhat shy. They arrive in December and stay until the end of April.

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[1] According to Professor Newton's *Dictionary*, p. 11 the name avadavat, with its variants amadavat, amidavad, etc. is a corruption of Ahmedabad the town in Guzerat whence, more than 200 years ago, according to Fryer (*New account of East India* etc. London, 1698), examples were brought to Surat.

[2] We agree with Ticehurst (J.B.N.H.S., xxxii, p. 345) that it is useless recognising the intermediate race *kubanensis*.

In the Nelliampathies the Rose Finch is also fairly common (Kinloch). In Travancore it is only found in the High Ranges and not further south. Here too it is fairly common in flocks in sholas and open country from December to March.

The unusual and marked season for the Rose Finch in the South-west of the Presidency has probably some connection with the fruiting season of mulberries and bamboos further north. It breeds late in the Himalayas laying from the middle of June to the end of July.

Gymnorhis xanthocollis xanthocollis (Burton).

Fringilla xanthocollis Burton, Cat. Birds Mus. Fort Pitt, Chatham (1838), p. 23—Ganges between Calcutta and Benares.

Specimens collected:—547-549 ♂ ♀ ♀ 18-7-29, 564 ♀ 20-7-29, 578 o? 22-7-29 Gingee; 918 ♂ 14-10-29 Seschachalam Hills 2,000 ft.; 1154 ♂ 21-12-29 Cumbum Valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	14-14.5	79.5-85	46-52	16.5-17.5 mm.
3 ♀	14.5-15	78-80	43.5-50	16.5-18 mm.

There is very little information about the status of the Yellow-throated Sparrow on the eastern side of the Presidency, the only previous record being for Madras where Dewar says it is fairly abundant.

On the Eastern side, Betts says that it is common and resident in Coorg. William Davison saw it in the Wynaad and says that it occurs on the slopes of the Nilgiris up to about 4,000 ft., being most numerous on the Seegore Ghat.

Fairbank found it plentiful at Periakulam near the base of the Palnis. In Travancore it is said to be fairly common in the low country, breeding there in May and June (Ferguson).

Passer domesticus indicus Jardine and Selby.

Passer indicus Jardine & Selby, Illustr. Orn., vol. iii, pl. 118 (1835)—India, Bangalore.

Specimens collected:—442 ♂ 18-6-29 Harur 1,000 ft.; 494 ♀ 3-7-29 Kalai.

Measurements:—(♀ is in moult).

	Bill.	Wing.	Tail.	Tarsus.
♂	15	75.5	51	18 mm.

Unfortunately the House Sparrow was neglected by the Survey and we have therefore no information at all as to whether it occurs in the Presidency north of Madras, though one may perhaps assume that it is generally distributed wherever there are human habitations. This, at any rate, is the case throughout the west of the Presidency and in the Nilgiris the bird occurs at all elevations.

In Travancore, however, Ferguson says that it ascends the hills 'at times'. In the low country he gives the breeding season as February and March. Elsewhere the breeding season is not recorded.

I am unable to agree with Mr. Stuart Baker in his division of the House Sparrows of India proper into two forms about the line Bihar-Chota Nagpur. The series from Southern India available is admittedly weak but those which I have examined (and with them also agree a small series obtained by the Hyderabad Survey, reported on elsewhere) do not appear to me to differ in colour or size from the birds of North India, south of the Himalayas. It was unnecessary for Mr. Stuart Baker to restrict the type locality to Karachi as Selby's specimens were obtained for him by Lt. Atherton at Bangalore (see Kinnear, Ibis 1925, p. 752).

Emberiza icterica Eversmann.

Emberiza icterica Eversmann, Uchen. Zap. Kazansk. Univ., 1841 (1), p. 161—Rocky eastern shores of Caspian Sea.

The Red-headed Bunting evidently occurs as a winter visitor to the Presidency. There are two males in the British Museum marked 'Madras Jerdon', and Jerdon himself says (B. of I., vol. ii, p. 379) 'I have seen it rarely in Coimbatore, in Mysore, Cuddapah and the edges of the Eastern Ghats'. Hume tells us (S.F., x, 403) that he believes it occurs in the Wynaad at times. Beyond this I have no information about it in our area.

Delichon urbica urbica (Linnaeus).

Hirundo urbica Linn., Syst. Nat., ed. x, vol. i (1758), p. 192—Sweden.

The House Martin has only been recorded from the western side of the Presidency and there but seldom. William Davison says that he once met with it in the Nilgiris—though no specimens appear to have been preserved—when a small party were flying about a steep cutting on the old road between Ootacamund and Coonoor. Hume recorded (S.F., i, 323) that he received 3 specimens from Coimbatore from Mr. H. R. P. Carter. These are in the British Museum and are dated 10-1-73 (♂ ♀) and 28-1-73 (♂) and there is a fourth undated bird from the same locality. There is also a Travancore specimen in the British Museum from Surgeon-General Fry but it has no more precise data. The bird is doubtless only a winter visitor in this area and one cannot help feeling that there may be a mistake about the breeding colony reported (Coussmaker, N. & E., ii, 177) in the bed of the R. Tunga in the Shemogah district, Mysore, on May 1st. At any rate if the specimen from Shemogah in the Hume collection, dated 27-4-1875, has any connection with this record it is undergoing a complete moult and can hardly therefore have been breeding.

Riparia rupestris (Scopoli).

Hirundo rupestris Scopoli, Annus I. Nat. Hist. (1769), p. 167—Tyrol.

William Davison tells us that the Crag Martin is a cold weather visitor, though never numerous, to the Nilgiris in the neighbourhood of Ootacamund. All leave by the end of March.

It probably is more widely spread than this record indicates as Terry (S.F., x, 469) was under the impression that a number of Crag Martins seen by him round some high cliffs at Pittur in the Palnis belonged to this species.

Riparia concolor (Sykes.)

Hirundo concolor Sykes, P.Z.S. 1832 (July 31), p. 83—Dukhun = Poorundhur 4,000 ft., W. Ghats.

Specimens collected:—877 ♂ 5-10-29 Seschachalam Hills 2,000 ft.; 1044-1045 ♂ ♂ 5-12-29 Cumbum valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	10	109-110	45.5-46	9-9.5 mm.

The Dusky Crag Martin is not known to occur in the Presidency north of the Krishna River. Below that in addition to the localities furnished by the Survey it occurs at Udyagiri, Vellore, whence Dr. Gravely kindly informs me there is a specimen in the Madras Museum.

On the western side I have examined a specimen (Coll. Bombay N.H.S.) obtained by Mr. J. P. Cook on 11th January in the Wynaad. In the Nilgiris, according to William Davison, it is found at all elevations as a not uncommon winter visitor, a few birds also staying to breed.

Hirundo rustica gutturalis Scopoli.

Hirundo gutturalis Scopoli, Del. Flor. et Faun. Insub., vol. ii (1786), p. 96—Antique in Panay, Philippines.

Specimens collected:—1076 ♂ imm. 1078 ♂ ad. 10-12-29; 1084 ♂ ad. 1086 o? imm. 11-12-29 Cumbum valley.

Measurements:—

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
2 ♂ ad.	10.5-11.5	110-117	39-41	moult	10 mm.
1 ♂ imm.	11	113	40.5	62.5	9.5 mm.

I can find very little recorded about the Swallow in the Madras Presidency. On the eastern side, the above Survey records are only supplemented by Dewar's bald inclusion of the species in his Madras list. On the west, it is certainly a common winter visitor and doubtless also a passage migrant on its way to Ceylon. In Coorg Betts tells us that it is common and that his earliest date for it is September 28th. In the Wynaad and Nilgiris, Hume (S.F., x, 345) considered it generally distributed though not ascending the hills to any great height. In Travancore Ferguson says that it is fairly common throughout the hill country.

Ticehurst (J.B.N.H.S., xxxii, p. 349) has carefully discussed the differences between *H. r. rustica* and *H. r. gutturalis* and shown that the best of the usual characters given for their separation is size. Unfortunately however the Swallow, both adult and immature, moults in its winter quarters and on this account, it is impossible to verify the racial identification of the large proportion of the available specimens from Peninsula India. This difficulty is aggravated by the unreliability of the sexing of a further proportion of specimens. I have therefore not been able to work out the ranges of these two forms in India with any accuracy though my impression is that the typical form is more confined to the North-West and West than is usually realised whilst *gutturalis* overlaps the borders of its range and occupies the rest of the Peninsula. The Survey specimens certainly belong to the race *gutturalis* as does also the only other specimen, ♀ 28-2-80 Quilon (Bourdillon, British Museum), which I have examined from our limits.

Hirundo javanica domicola Jerdon.

Hirundo domicola Jerdon, Madras Jour. Lit. Sci., vol. xiii (1844 after April), pt. i, p. 173—Nilgiri Hills.

Mr. Betts informs me that he has found a pair of these birds living and breeding in a bungalow at Mercara, Coorg. This is the first record of the Nilgiri Swallow north of the Nilgiris where as its name implies it is a common resident, very familiar and tame. Southwards it is common on the hilly downs of the Cochin Nelliampathies (Kinloch, J.B.N.H.S., xxix, 565) the Palnis (Fairbank and Terry) and the Travancore ranges at 4,000 ft. and upwards (Bourdillon and Ferguson).

The Nilgiri Swallow is said to be double brooded and to breed from the last week of February until June in the Nilgiris, April perhaps being the month in which most eggs are to be found. In Travancore, Ferguson and Bourdillon say that it breeds in March, April and May.

Our Indian and the Ceylon birds are said to differ from the typical race (Java) in having a smaller bill and the gloss of the upper parts greener in colour. Unfortunately the series available is not very satisfactory but we are far from certain that these distinctions hold good. Fresh material may be expected in the Travancore Survey and we shall then hope to settle the point.

Hirundo smithii filifera Stephens.

Hirundo filifera Stephens in Shaw's Gen. Zool., vol. xiii (2) (1826), p. 78—India.[1]

The Wire-tailed Swallow is only recorded from the N.-W. borders of the Presidency where it reaches the southern limit of its distribution. The only published record is that of Vipan (S.F., i, 495) who on 2 February 1871 shot three specimens and saw others about 5 miles from Cannanore and about 200 yards from the coast. The following specimens are in the British Museum and they probably came from much the same area though precise data is lacking:—One Coorg (Tweeddale Coll.), two Malabar (Tweeddale and Sharpe), two 1868 Coonoor (Hume Coll.), one Madras (Elliot).

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[1] Based on Latham, Gen. Hist. of Birds, vol. vii, p. 309 'From the drawings of Sir J. Anstruther', who was Chief Justice of Bengal and therefore probably obtained his specimen near Calcutta.

Hirundo fluvicola Blyth

Hirundo fluvicola Blyth, J.A.S.B., vol. xxiv (1855), p. 471—Bundelkhund.

The Indian Cliff-Swallow is only included in the Presidency list in virtue of a specimen in the British Museum obtained by Mr. Carter at Coimbatore on 28 August 1873. This furnishes the most southerly record of the species.

In the *Old Fauna* the easterly limit of distribution of the Cliff-Swallow was given as Etawah. This has since been extended to Gonda (Field, J.B.N.H.S., xxviii, 759) and Mirzapur (Gill, J.B.N.H.S., xxix, p. 767). The *New Fauna* is however wrong in extending it still further east to Sikkim on the strength no doubt of 4 birds in the Seebohm collection labelled by Seebohm 10-2-1876 Darjeeling (Mandelli). These birds bear also Andrew Anderson's original labels marked simply with the scientific name, sex and date but no locality. It is evident that Seebohm obtained them through Mandelli and assumed that the latter collected them in the Darjeeling district, whereas as a matter of fact they had been collected in the United Provinces by Anderson.

Hirundo daurica erythropygia Sykes.

Hirundo erythropygia Sykes, P.Z.S. 1832 (July 31), p. 83—Poona, Dukhun.

Specimens collected:—488-489 ♂ ad. o? ad. 2-7-29 Trichinopoly; 517 ♂ imm. 5-7-29 Kalai; 784 ♂ ad. 2-9-29, 812 ♀ ad. 13-9-29 Kodur 500 ft.; 885 ♂ imm. 7-10-29 Seschachalam Hills 2,000 ft.; 1666 ♀ ad. 6-4-30 Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Central t. f.	Outer t. f.	Fork.	Tarsus.
2 ad. ♂	9	106-109	40-40.5	72.5-78	32.5-39	13-14 mm.
2 ad. ♀	10	106.5-107	42.5-43	70.5-75.5	28-32	13-14 mm.

Sykes' Red-rumped Swallow must be very generally distributed in the Presidency, doubtless as a resident species. Jerdon says that he saw it in Gumsoor. The Survey found it common and breeding at 5,000 ft. at Sankrametta and LaPersonne remarks that it may be met with anywhere in the hills of Vizagapatam district. Red-rumped Swallows were also seen by the Survey commonly over the plains of the Velikonda valley (Cuddapah), on the Shevaroys and on the Chittiri plateau in addition to the specimens enumerated above. On the west, Betts says that it is a fairly common resident in the drier parts of Coorg and a specimen from there is in the Tweeddale Collection. William Davison says that it is common throughout the Wynaad and the Nilgiris at all elevations up to the summit. There are six specimens from various places in the Nilgiris in the British Museum. Terry saw it in April at Pulungi in the Palnis. In Travancore, Ferguson says it is found throughout the low country and he shot one in the High Range at over 5,000 ft. A Travancore specimen (Fry) is in the British Museum.

The breeding season in the Nilgiris is said to be in April and Davison relates a curious case of a Swallow being walled up alive in its nest on its young and perishing there.

Motacilla alba dukhunensis Sykes.

Motacilla dukhunensis Sykes, P.Z.S. 1832 (31 July), p. 91—Dukhun.

Specimens collected:—1075 ♂ 9-12-29, 1118 ♀ 15-12-29 Cumbum valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	16	90	92	23 mm.
♀	15	85.5	88	22 mm.

There are very few records of the White Wagtail in the Presidency in addition to the above specimens obtained by the Survey. Hume says (S.F., x, 395) that it is common below the foot of the Coonoor Ghat. Ferguson says that he collected specimens in 1901, both at Pirmade and on the High Range in Travancore and again in the low country at Alwaye in North Travancore in January 1903. These specimens are not in the British Museum.

Motacilla maderaspatensis Gmelin.

Motacilla maderaspatensis Gmelin, Syst. Nat., vol. i, pt. ii (1788), p. 961—Madras.

Specimens collected:—495 ♀ 3-7-29, 527-529 7-7-29 Kalai, Trichinopoly; 584-585 ♂♀ 22-7-29 Gingee; 791 ♂ 3-9-29, 801, 802, 805 ♂♀♂ 11-9-29, 836-837 ♀ 20-9-29 Kodur 500 ft.; 1073 ♀ Cumbum valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	19-20	92-101.5	97.5-107	25.5-27 mm.
8 ♀	18.5-20.5	93.5-97	95-103	25-26.5 mm.

There is no record of the Large Pied Wagtail in the Presidency north of the Krishna River. South of that river it appears to be very generally distributed as a resident throughout the low country, and there is no need to cite individual records. How far it ascends the Eastern Ghats is not very clear and on this side there is as yet no available evidence that it is found in the hills. On the west it is to some extent a hill bird for a few pairs frequent the lake at Ootacamund (Davison) and the Pykara River (Betts). Terry saw one at the end of May beside a stream at Pumbarrah in the Palnis. In Travancore, according to Ferguson, it does not ascend the hills at all.

In Travancore Ferguson says that the breeding season is at the end of the year and H. R. P. Carter (apud. Hume, N. & E., ii, 203) reported c/3 eggs on 17th December and 2 more eggs in the same nest on 20 January by the banks of the Cauvery. There is no other information about the breeding season in the Presidency.

This fine Wagtail has been treated as a race of the White Wagtails of Europe and Northern Asia, apparently merely on the grounds of geographical replacement. But those who hold other criteria for the recognition of races and desire to extract as much information as possible from their study as an aid to the significance of evolution and geographical distribution will have no hesitation in considering this a well defined species without any races of its own.

The *alba* group of the northern hemisphere have as their characteristics a complicated sequence of summer and winter plumages, differing to a larger or smaller extent according to both age and sex; the corollary of a fairly complete spring moult; a soft type of feathering. The forehead, the earcoverts and to some extent the moustachial streak are plastic and important features, but the superciliary streak is less important. If *maderaspatensis* is an oriental race of this group one would expect some play on these characteristics; one would expect it to be smaller than the northern forms and one would expect that in the north-western Himalayas (where both forms meet for I have met both breeding on the same island in Kulu) intermediates would be found. The facts are far otherwise. The summer and winter plumage are absolutely alike, both sexes are alike; the plumage sequence is of the simplest, both male and female in first winter being alike and merely dull editions of the adult. There is no spring moult. There is no white forehead, the earcoverts and moustachial stripe have lost any distinctive feature and emphasis is on the supercilum. The plumage is tough. The size is larger than in the *alba* group and no intermediates have ever been recorded.

I have no hesitation in regarding our Indian bird as a well marked species with no races in its somewhat restricted distribution; to this opinion Ticehurst has also independently arrived (J.B.N.H.S., xxviii, p. 1089).

Gmelin's name was based on *La Bergeronette de Madrest* of Brisson, Ornithologie 1760, vol. iii, p. 478, *Motacilla maderaspatana* Brisson himself never saw a specimen but based his description on Ray's *Motacilla maderaspatana nigro alboque mixta*, Synopsis Avium (1713), p. 194, Nos. 3 and 4.

Motacilla cinerea caspica S. G. Gmelin.

Parus caspicus S. G. Gmelin, Reise Russ., vol. iii (1774), p. 104, pl. 20, fig. 2—Caspian Sea.

Specimens collected:—1000 ♀ 11-11-29 Nallamalai Hills 2,000 ft.; 1093 o? 12-12-29 Cumbum valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 specimens	15.5-16	82-84	90-92	19-20.5 mm.

As a winter visitor and a passage migrant on its way to and from Ceylon the Grey Wagtail is well known in the Madras Presidency. It is an early arrival—for in Ceylon it appears regularly in August (Brown, J.B.N.H.S., xxxii, p. 375)—and to that fact and its own sprightly and distinctive appearance it owes the fact that it occupies in the Presidency much the same position as the Swallow in England, its arrival and departure being regularly noticed.

On the western side it is very general and common in Coorg, the Nilgiris, Nelliampathies, Palnis and Travancore. In the last area Ferguson says that it is only found in the hills above 1,000 ft. The earliest dates which I find recorded are 21 August, Coorg (Betts), 23 August Nilgiris (Betts). The majority apparently leave by the end of March or middle of April but some birds, by then in breeding plumage, stay on into the beginning of May even as far south as Travancore. The latest record is 22 May (Nilgiris, Betts) but this is exceptional. Captain Bates has an interesting record at Mercara on 27 April 1924 when he saw large numbers flying down the Sidapur nala in the evening.

It appears to be far less common on the eastern side as there is no record at all north of the Kishtna river and the Nallamalai specimen has a note on the label that it was the first seen by the Survey. Dewar says that it is not in large numbers at Madras. Captain Bates met it at St. Thomas' Mount and he informs me that he first saw it there on 17 September 1929. There is a specimen from the Shevaroys in the Madras Museum.

Motacilla flava beema (Sykes).

Budytes beema Sykes, P.Z.S. 1832 (July 31), p. 90—Dukhun.

Specimens collected:—1079-1081 ♂♂♂ 10-12-29, 1166-1167 ♂ [♀] 23-12-29 Cumbum valley; 1229 ♂ 11-1-30, 1241 ♀ 1243 ♀ 1246 [♂] 13-1-30, 1284 ♀ 20-1-30 Godaveri Delta.

Measurements:—(No. 1229 omitted as sex and identity is not quite satisfactory.)

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	15-16	78-84	67-71.5	23-25 mm.
4 ♀	15-16	77-78	67.5-71	22-23.5 mm.

The *Old Fauna* gave the winter range of Sykes' Blue-headed Wagtail as extending in India as far south as Belgaum but in the *New Fauna* it is said to occur as far south as Travancore, a considerable extension based apparently on two Anjango specimens in the Hume Collection, of which the identification does not appear to me to be beyond dispute. Be that as it may the above Survey Series provides the only satisfactory evidence for the occurrence of this form in the Presidency. LaPersonne says that they were abundant in ploughed fields and on low sandbanks in the Godaveri delta in January and their numbers appeared to increase as the month wore on.

Published descriptions omit the point that the white supercilum of the male often includes a few yellow feathers and very occasionally these are numerous enough to make the supercilium appear yellow rather than white.

Motacilla flava thunbergi Billberg.

Motacilla thunbergi Billberg, Synops. Faunae Scand., pt. ii (1828), p. 50—Lapland.

One would expect the Grey-headed Wagtail to pass through the Madras Presidency in considerable numbers as in Ceylon (Wait, p. 153) it is said to be one of the commonest passerine visitors arriving about the middle of September and leaving again in April. Yet it is possible that these birds reach Ceylon by way of the Andamans and I have been unable to examine any specimens from the Presidency except two very old ones marked 'Madras' in the British Museum, whose data, condition and identification are not beyond doubt. Hume said (S.F., x, 396) that he had seen it from the Wynaad. Dewar says that great flocks occur at Madras every cold weather and Captain Bates tells me that one year on the evening of April 17th he disturbed a flock of about 200 birds, obviously migrating, in a dry rice field near St. Thomas' Mount. In neither case, however, do specimens appear to have been obtained in confirmation of the identification and yellow wagtails are notoriously difficult to tell both in the field and in the cabinet.

[**Motacilla citreola citreola** Pallas.

The *New Fauna* (vol. iii, p. 274) states that this race (or *M. c. werae* which at that time Mr. Stuart Baker did not recognise) occurs as far south as Travancore and Madras. It may do so and the species certainly occurs in Hyderabad State and is recorded in N. Kanara. The only record for the Presidency, which I can trace however, is an old skin of *M. c. werae* marked 'Madras Jerdon' in the British Museum and this is perhaps hardly sufficient to justify the inclusion of the Yellow-headed Wagtail in the Presidency list as yet.].

Dendronanthus indicus (Gmelin).

Motacilla indica Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 962—India.[1]

The statement, given currency in both editions of the *Fauna*, that the Forest Wagtail is found in winter in India east of a line between the Sutlej Valley and the Gulf of Cambay is very misleading. The Sutlej valley is evidently based on Stoliczka's record (J.A.S.B., 1868) that he had shot the bird in April near Koteghar in the Simla Hills. This must however have been a straggler as there is no other published record in Northern India west of Darbhunga where Inglis obtained a single bird, also evidently a straggler, on 1st October 1913 (J.B.N.H.S., xxii, p. 625). South of Koteghar and Darbhunga I can trace no other definite record until Mahableshwar (Fairbank) and the Godavery valley (Blanford) are reached and it seems probable that this species, like others, must reach its winter quarters in Southern India and Ceylon by way of the Eastern Ghats or the Andamans. It was not, however, procured by the Survey.

In the Madras Presidency, the Forest Wagtail is only recorded on the eastern side by Jerdon, who says that he met it in his garden at Nellore, and twice at Madras by Dewar. On the west it is better known.

In Coorg, according to Betts, it is a well distributed winter migrant though never very numerous. His earliest date for it was October 16th. In the Wynaad and the Nilgiris William Davison says that it is general but rare. Kinloch considered it quite a common bird in the Nelliampathies. There is as yet no record for the Palnis but in the Travancore Hills, Bourdillon (S.F., iv, 401) recorded it as a winter visitor arriving soon after and staying nearly as long as the Gray Wagtail—a description which proves not to be very precise.

(*To be continued*).

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[1] Based on Sonnerat with no precise locality. It must however refer to either the Coromandel or Malabar Coasts.

THE GAME BIRDS AND ANIMALS OF THE MANIPUR STATE WITH NOTES ON THEIR NUMBERS, MIGRATION AND HABITS.

BY

J. C. Higgins, I.C.S.

Part III.

(*Continued from page 606 of this volume.*)

Snipes.

Both the Fantail and the Pintail Snipe visit Manipur in large numbers, between August and May. The best year's bag recorded is that of 1926-27, when 5,900 were shot. Good days were:—

28-12-27	221	10 guns
28-9-14	212	3 ,,
4-10-31	210	2 ,,
2-10-29	208	1 ,,
8-10-30	204	1 ,,
30-9-27	194	2 ,,
12-10-30	170	1 ,,
29-9-29	167	1 ,,
28-9-27	152	1 ,,

The bag of 221 (142 Fantail, 72 Pintail, 6 Jack, 1 Wood) was made round the edge and on islands on the Loktak lake, at the Christmas shoot of 1927: that of 212 (161 Fantail, 49 Pintail, 2 Painted, with 26 Golden Plover and 1 Black Partridge) on grazing grounds, after a sudden rise of the rivers had flooded all the *bils* and driven out the snipe: the bag of 210 (192 Fantail, 18 Pintail, with 1 Garganey) was made in newly transplanted paddy: those of 208 (205 Fantail and 3 Pintail, with 1 Golden Plover) and 204 (193 Fantail and 11 Pintail, with 1 Golden Plover) on a *bil* covered with *dhup* grass, with pools and patches of open mud, interspersed with clumps of low reedy grass and a water plant locally known as *chaokhong*. I do not know the scientific name of this plant: it has a small red flower and, when dead, a black jointed stem, and snipe are very fond of lying in it. On September 28th, 1929, my shikaris, who live on the edge of this *bil*, told me I could get 50 couple there. I went out next day, shot 167, and ran out of cartridges. On October 2nd, I went out again, and found the birds just as numerous. But unfortunately a strong wind got up in the afternoon and made them very wild: but for that I should have gone near 150 couple. In 1930, another gun and I bagged 143 birds on the same *bil* on October 4th. On October 8th I returned and shot 204, though the birds were not quite so numerous as in the previous year. On October 12th, two guns bagged 100 over the same ground. In 1931, however, the water was too high when the Fantail migration was taking place and the *chaokhong* was very thick, with the result that less than 50 birds were shot there in the whole season.

Big early bags were:—

27-8-16	...	94	3 guns
29-8-16	...	78	2 ,,
25-8-28	...	71	1 ,,

Big late bags were:—

18-4-32	...	145	2 guns
20-4-19	...	137	3 ,,
11-4-24	...	128	2 ,,
27-4-19	...	109	4 ,,
4-4-29	...	108	1 ,,
16-4-32	...	104	2 ,,
19-4-32	...	100	2 ,,
1-5-27	...	81	2 ,,

The following table shows the total number of snipe of each species shot since 1911, and their percentage of the total bag of snipe:—

Fantail	...	33,536	58·96 per cent
Pintail	...	22,540	39·70 ,,
Jack	...	539	0·96 ,,
Wood	...	207	0·38 ,,
Solitary	...	3	...

The Woodcock (*Scolopax rusticola rusticola*)—Manipuri—*sābal kaodruk* (not kāngdruk, as in Finn[1] and Baker,[2] which is the Painted Snipe).

The Woodcock is a regular winter visitor to Manipur, where it is found in small wooded streams at the foot of the hills surrounding the valley, and also in suitable thickets in the large gardens which surround the houses of the inhabitants, especially when a stream flows through the village. I have seen Woodcock on four occasions in the Residency garden, in the middle of the town of Imphal. The earliest recorded was shot on November 11th (1916). One was reported on August 4th of the same year, but of this I am very doubtful. Another, reported on October 14th, 1930, was probably really a Woodcock, as my informant was very reliable. The latest I have shot were two birds on April 5th, 1930, but Colonel A. E. Woods, who was then Political Agent, noted in his tour diary that he shot three on April 17th, 1903, and two next day. It is just possible that these may have been Wood Snipe, as the localities from which they were obtained harbour both species, and I have known the Wood Snipe to be claimed as a Cock before now. But on the other hand, I think there is no doubt that the Woodcock does stay in Manipur till the end of April. A Manipuri, in whose village the Woodcock is a regular visitor and who is very familiar with the bird, having regularly given me *khubber* of them several years, reported having seen one in his village on April 29th, 1932, and another in a neighbouring village on the following day. When I went to look for them on May 2nd, they had disappeared. A bird reported on June 14th, 1925, was probably not a Woodcock at all. I do not think the Woodcock breeds in Manipur. My shikaris, on hearsay evidence, used to declare that it did. But although I offered a reward for birds, nests or eggs in the breeding season, they failed to produce them, and now admit that it is improbable that it does breed in the valley. It is possible that it may breed in the surrounding hills, which run up to nearly 10,000 ft. in places.

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[1] Op. cit., p. 92.

[2] *Fauna of British India*, vol. vi, p. 252.

The best years recorded are 1927-28 and 1928-29, when 29 were shot, and 1930-31, which yielded 41. They were plentiful in the latter year, and upwards of 50 could have been bagged, if several regular guns had not been on tour in the hills for part of February and most of March. The best day's bag was made on January 30th, 1931, when I shot 7 in a chain of Manipuri villages, and saw an eighth at which I did not get a shot. Five have been bagged on three occasions.

Finn[1] quotes Hume as saying that the Woodcock is 'a sluggish flyer and easily shot'. This is true of the very rare occasions on which he comes out into the open, though I once saw a very fair shot miss, probably out of sheer astonishment, when two got up literally at his feet in a field of frozen turnips. He had every reason to be surprised, for what they were doing there, at least half a mile from the nearest wood, is a mystery. But a bird that is twisting through the trees, whether driven across a narrow ride in a wood in England or flushed from a stream or swamp in an Indian jungle, is a very fair mover and remarkably easy to miss. But the village Woodcock in Manipur is not so difficult as the wild one, except for the fact that one has to be continually on the watch not to bag one of the numerous spectators as well as or instead of the bird. From constant association with man, it is reasonably tame and flies from one thicket or clump of bamboos to another, usually settling not very far away. In fact, I have known a bird to be shot the seventh time it was flushed. But with its uncertain flight, dodging between houses and through hedges, it often gives the unexpected sporting shots which make it so interesting to pursue.

Baker[2] refers to the Woodcock as 'rather a stupid bird and an easy prey to trappers'. This it is in the Manipuri villages, where I have not uncommonly heard of them being knocked down with a stick. I have on several occasions seen them running along a hedge or ditch in a village, and once saw a bird, flushed by beaters, settle on a high mud wall.

The Wood Snipe (*Capella nemoricola*)—Manipuri, *cheklaobi amubā* ('the black snipe').

The question to what extent the Wood Snipe migrates, if at all, does not seem to have been satisfactorily settled. Baker[3] says of it that 'it will probably be found that its migrations are of a very local character and it would not surprise me to find that over the greater portion of its habitat it is a permanent resident'. The earliest bird recorded in Manipur was shot on September 9th, 1931, and the latest on May 12 (1932). But only 6 have been shot in September and 4 in May. The bird shot on May 12th was very probably migrating, as it was in very poor condition and appeared to weigh little if any more (I did not actually weigh it) than the very fat Pintail snipe shot on the same day. The percentages of this species shot in the various months of the season are:—

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[1] Op. cit., p. 92.

[2] *Game Birds of India, Burma and Ceylon*, vol. ii, p. 32,

[3] Op. cit., p. 50.

September	... 3 per cent
October	... 6 ,,
November	... 10 ,,
December	... 15 ,,
January	... 5 ,,
February	... 17 ,,
March	... 27 ,,
April	... 15 ,,
May	... 2 ,,

The high percentage of March is due to the fact that a number of Wood Snipe are bagged out partridge shooting in damp patches of grass at the foot of the hills. Baker[1] quotes the late Colonel A. Wilson, 8th Gurkha Rifles, as having found 'many Wood Snipes' in May, in a glen of the Manipur valley on the east. I have never found or heard of more than an odd one in that month, though they are comparatively common in April. But this does not prove that they do not exist in the valley in May, as the scarcity of snipe and the difficulty of moving over the roads after April reduce shooting to a minimum. As in the case of the Woodcock, the shikaris formerly used to declare that the Wood Snipe bred in Manipur. But the offer of a reward has never produced bird, nest or eggs, and they have come to the conclusion that it does not breed.

Baker[2] quotes Damant as saying that the Wood Snipe was 'common in Manipur', on the strength of having shot 5 in a morning. But Damant was only speaking relatively, in comparison with other localities. Wilson bagged 8 on October 2nd, 1896, and could have killed more: but although I have shot frequently in the neighbourhood of his camp, I have never been able to identify the 'Choonbutti' to which he refers (there are numerous lime-kilns in those parts), nor have I ever seen more than an occasional Wood Snipe. Good days in the past twenty years have been:—

12-11-16	... 6
14-12-29	... 6
28-12-24	... 5
18-3-28	... 5
8-2-29	... 5

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[1] Op. cit., p. 51.

[2] Op. cit., p. 50.

The total bag of Wood Snipe since 1911 is only 207, the best year being 1929-30, when 25 were shot.

The description given by Baker[1] of the Wood Snipe's flight as 'slow and owlish' is an excellent one, and they are very easy to shoot. Finn[2] refers to it as being 'always alone', but this description may have been borrowed from Hume, who qualifies it by saying that 'it is always solitary (in the hills at any rate)'. In the swamps and grassy valleys of Manipur the Wood Snipe not infrequently occurs in pairs, and I have seen three or four get up out of the same small patch of grass.

The Wood Snipe is inferior to the other snipes as a table bird.

The Eastern Solitary Snipe (*Capella solitaria*)—Manipuri, *cheklaobi.*

Baker[3] does not record the Solitary Snipe as having been obtained in Manipur, though he mentions Cachar on the west and the Chin Hills on the south in its habitat. I have shot two, one on December 20th, 1916, in the stony bed of a tributary of the Manipur river in the south of the valley, at 2,700 ft., and the other on February 7th, 1931, in a small stream in the north of the valley, at 3,000 ft. I missed another in the latter stream, almost in the same spot to a yard, three or four years ago. Mr. A. Chrystall shot one in another small stream in the north of the valley, at 3,200 ft., on December 14th, 1929. All these birds were close to the foot of the hills. No others have been recorded, but on April 3rd, 1929, my shikari reported having seen a large light-coloured snipe in a bog in the valley at about 2,500 ft., distant from the hills: this bird may have been a Solitary Snipe.

Baker[4] quotes Hume as saying that this species and the Wood Snipe may be 'flushed within a short distance of each other'. I shot a Wood Snipe this year almost to a yard where I shot the Solitary Snipe in February, 1931.

Finn[5] says that the Solitary Snipe breeds in the Chin Hills. I have no information of its breeding in Manipur, where the hills are higher, and which lies north of the Chin Hills.

The Common or Fantail Snipe (*Capella gallinago gallinago*)—Manipuri, *cheklaobi* ('calling "chek" '), not, as given by Baker,[6] *cheklonbi.*

The description of the Fantail Snipe's migration given by Baker[7] applies to Manipur: he says that 'it arrives by twos and threes at the end of August and by innumerable thousands in September and October . . . In North-East India . . . few birds stay after the middle of April, but a few are shot now and then even in May'. The inward migration does not really begin until September is well in, and the crest of the wave is reached in the last week of that month and the first of October, when the largest bags are made. Many of the birds must pass on, as they become much scarcer in the cold weather, returning again, but in far smaller numbers, in the spring. The earliest recorded was shot on August 16th, 1931, and my shikari reported having seen one (probably the same bird) on the previous day: but they are very rare in August, only 12 having been shot in that month since 1911. They are found in April, in the proportion to the Pintail of about 1 to 4, but fade away rapidly after the middle of the month. In May they are scarce: 134 have been shot since 1911, of which number exactly half were bagged in one extraordinary day. The last recorded shot was bagged on May 20th, 1917. Five reported by my shikari on June 4th, 1929, may not have been pricked birds, but another seen on June 27th, 1932, and one shot by Colonel Goodall on July 9th, 1930, almost certainly were. The last mentioned had been seen in the same place once or twice in June.

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[1] Op. cit., p. 53.

[2] Op. cit., p. 83.

[3] Op. cit., p. 39.

[4] Op. cit., p. 43.

[5] Op. cit., p. 83.

[6] *Fauna of British India*, vol. vi, p. 259.

[7] Op. cit., p. 260.

The relative numbers of the Fantail and the Pintail are discussed by Baker[1] in his chapter on the latter bird. He quotes Blanford as saying that 'in Assam, Sylhet, Cachar and throughout Burma, *Gallinago stenura* is the snipe of the country'. This is, on the whole, incorrect of Manipur, where the relative proportions, calculated on a total of upwards of 56,000 birds killed, are almost exactly 3 Fantails to 2 Pintails. But, as Baker[2] points out, the 'number of Pintail compared with Fantail varies very greatly in accordance with seasons'. In the years 1918-19, 1921-22 and 1923-24 the bag of Pintails exceeded that of Fantails. The table below compares the numbers and percentages of Fantails and Pintails shot in each month since 1911 (the year from which the classification of the snipes began):—

Month.	Fantail.		Pintail.		Total.
	Number.	Per cent.	Number.	Per cent.	
August	12	...	4,254	19	4,266
September	6,184	18	7,652	34	13,836
October	13,053	39	2,225	10	15,278
November	2,613	8	350	2	2,963
December	3,622	11	779	3	4,401
January	2,779	8	661	3	3,440
February	2,357	7	973	4	3,330
March	1,629	5	917	4	2,546
April	1,152	4	4,290	19	5,442
May	134	...	438	2	572
June	...	...	...	...	...
July	1	...	1	...	2
Total	33,536		22.540		56,076

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[1] *Game Birds of India, Burma and Ceylon,* vol. ii, p. 91.

[2] Op. cit., p. 91.

This bears out Baker's[1] statement that 'to the east the Pintail predominates enormously during the early and late periods of its stay'—August, early September, and April.

The best year's bag of Fantail Snipe is 3,602, in 1927-28, and the best month's 1765, in October, 1926. Good days were:—

2-10-29	... 205
8-10-30	... 193
4-10-31	... 192
30-9-27	... 181
12-10-30	... 163
28-9-14	... 161
29-9-29	... 157

Twenty-three other bags of between 100 and 150 (exclusive of Pintail) have been recorded. On May 1st, 1927, Colonel Goodall and I shot 67 Fantail and 14 Pintail—an extraordinary large bag, both of snipe generally and Fantail Snipe in particular, for the time of year.

Baker,[2] discussing the vexed question as to whether the Fantail is harder to shoot at home than in India, definitely and rightly decides that it is, on account of it being wilder and also flying faster in Europe. Finn[3] supports him, saying they 'afford easier shots in India'. Nearly all the snipe I have seen at home are very much wilder than the Indian bird. Baker records an orderly having caught a snipe in his hand, and one of my Labradors caught one which had certainly not been wounded that day. Such a thing is, I think, impossible at home. I remember one winter shooting in water meadows, with snow on the ground and all the pools covered with ice, when we saw between 50 and 100 snipe and never succeeded in getting near enough to them to get one single shot, though we bagged some mallard and teal. Another factor in favour of Indian shooting is the light, which is very seldom as dull as it often is at home: a bright sunny day (if not too hot) makes birds very much easier to hit, irrespective of the fact that they may also be rising closer and flying more slowly.

Another point discussed by the authorities, and with far less unanimity, is whether it is better to shoot at snipe as they rise, or to let them get well on the wing. Both Baker[4] and Finn[5] agree that it is a matter of individual taste and habit. Without presuming to the skill of either Mr. Cornish or Mr. E. B. Baker, I personally incline towards letting them have it as soon as possible, especially if they are on the wild side. But you will miss a lot of birds both ways.

Finn[6] quotes Colonel Tickell as saying that snipe like 'puddles coated over with a film of irridescent oily matter'. In Manipur I have found exactly the reverse, and snipe definitely seem to dislike dirty water of this kind.

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[1] Op cit., p. 92.
[2] Op. cit., p. 67.
[3] Op. cit., p. 78.
[4] Op. cit., p. 70.
[5] Op. cit., p. 78.
[6] Op. cit., p. 77.

Radde's Snipe or The Eastern Fantail Snipe (*Capella gallinago raddii*).

There is no record of this species having been shot in Manipur, though it probably occurs. I have noticed Fantails with peculiarly white under-wings, but have never had the patience to examine my bags closely and systematically for subspecies.

The Pintail Snipe (*Capella stenura*)—Manipuri, *cheklaobi.*

The Pintails begin to arrive at the very beginning of August and sometimes in July. The earliest shot was on August 2nd (1930), and in the past 7 years some have been bagged annually before August 10th. The shikaris often report odd birds towards the end of July, and in 1926 my shikaris and others reported having seen several as early as the 18th and 19th July. I myself saw a bird on July 20th, 1912, and chased it for a considerable distance, but I cannot swear to it being a Pintail. One shot on July 5th, 1932, by Captain Bulfield, was presumably a late stayer and not an early arrival, as was another reported on July 13th, 1932. The latest recorded were shot on May 24th, 1919. The shikaris had reported seeing about 30 two days previously, after heavy rain. The distribution of the bag among the different months of the season has been recorded above in the note on the Fantail Snipe.

The best year's bag of Pintail was in 1931-32, when 2,381 were shot: this was an excellent year for them, especially in the spring, April yielding 723. The best month's bag was 864 in September, 1926. Good days were:—

18-4-32	... 142
20-4-19	... 132
8-9-26	... 107
27-4-19	... 106
11-4-24	... 103

On December 28th, 1927, 72 were shot—a large bag for the time of year. But 10 guns were out.

The Pintail's readiness to settle on dry ground as well as in wet, remarked upon by Baker[1] and Finn,[2] is very noticeable in Manipur. The Fantail is essentially a bird of the *bils*, though when it first comes in it settles on the wet grazing grounds with the Pintails, if the water in the *bils* is too high. The Pintail starts in the grazing grounds at the end of the rains, is found in the cold weather in gardens, streams, small wet patches in the paddy stubbles near the foot of the hills, and dry bogs containing pools. In April it is found in the bogs, wet and dry.

Baker[3] recounts how a friend of his was able to distinguish with certainty between the Fantail and the Pintail on the wing. I have never succeeded in doing so, except when the bird turns so as to expose the underside of the wing. But my shikari never makes a mistake, and says that he distinguishes them by the difference in the call, but more surely by the flight, the Fantail's wing movements being swifter than the Pintail's. This goes to confirm the opinions of Hume, Stuart and Parker, quoted by Baker. Hume is certainly correct in saying that the Pintail's flight is 'less zigzaggy' than that of the Fantail, and I am inclined to think it is more silent.

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[1] Op. cit., pp. 96, 97. [2] Op. cit., p. 80, [3] Op. cit., p. 102.

I join issue with Baker[1] and Finn[2] as to which is the better table bird. The Pintail, I have always found, gets into condition far more rapidly than the Fantail, and shares with the Garganey Teal the quality of possessing a thick layer of fat between the skin and the breast, with which it bastes itself. I always pick the Pintail out of the bag for the house.

Swinhoe's Snipe (*Capella megala*).

Like Radde's Snipe, this species probably occurs occasionally in a place where snipe are as plentiful as they are in Manipur, and where several of the more easterly species occur as stragglers. But it has not been recorded, and here again the reason is doubtless to be found in the fact that no one has taken the trouble to examine their bags with sufficient care.

The Jack Snipe (*Lymnocryptes minima*)—Manipuri, *cheklaobi.*

Of the migration of the Jack Snipe, Baker[3] says that it 'possibly arrives a little later than the Fantail and never stays quite as late as the latest Fantails or Pintails'. In Manipur the Jack arrives later and departs earlier than the Fantail, without any doubt. The earliest record of Jack Snipe is one shot on September 24th, 1916, but this is the only occasion on which it has been bagged in September, and it is far from common in October. It again becomes increasingly rare in February and March, and only 6 have been shot in April, the latest recorded having been killed on April 11th, 1924. The percentages shot in the different months of the season are:—

October ...	9 per cent
November ...	24 ,,
December ...	32 ,,
January ...	19 ,,
February ...	10 ,,
March ...	5 ,,
April ...	1 ,,

Baker[4] says of its distribution that it is 'very irregular and not nearly as common as the Pintail or the Fantail'. This is very true of Manipur, where the Jack Snipe is decidedly scarce, having provided only 539 birds since 1911, or 96 per cent of the total snipe bag. As regards the irregularity of migration, commented on by both Baker[1] and Finn,[2] it may be noted that the Manipur bags vary from 1 in 1921-22 to 81 in 1915-16. The last is the only year in which I have ever seen the Jack really plentiful, and provided the only occasions on which anything approaching a real bag of them was made. On January 2nd, 1916, two guns shot 28 Jack, out of a bag of 75 birds, and on November 22nd, 1915, a bag of 40 snipe contained 17 Jack.

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[1] Op. cit., p. 103.
[2] Op. cit., p. 81.
[3] Op. cit., p. 117.
[4] Op. cit., p. 110.

Baker[3] has remarked on the Jack's peculiar affection for corners and cover. In Manipur it is almost certain to be found in *bils* where a certain dark green grass, some 1½ ft. high, grows in clumps and patches among the *dhup* grass and mud.

The Jack Snipe is, in my opinion, far superior to his bigger cousins as a table bird.

The Painted Snipe (*Rostratula benghalensis benghalensis*)—Manipuri, *kāngdruk.*

This species resides and breeds. It is not really plentiful, in comparison with the migratory snipe, and is not so common in Manipur as it is in parts of the Assam valley, though I have seen ten to fifteen in one place. No large bags are made, as they are not usually shot, except for the pot or by novices. The best year's bag is 103, in 1916-17.

(*To be continued*).

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[1] Op. cit., p. 112.

[2] Op. cit., p. 87.

[3] Op. cit., p. 117.

THE PALM CIVETS OR 'TODDY CATS' OF THE GENERA PARADOXURUS AND PAGUMA INHABITING BRITISH INDIA.

BY

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Part I.

(*With 2 text-figures*).

Introduction.

This paper is based mainly upon the splendid collection of skins, mostly measured in the flesh and dated, and skulls obtained by the collectors employed by the Bombay Natural History Society's Mammal Survey of British India and by forest officers, sportsmen and others interested in the project. Before this collection came to hand, the material in the British Museum consisted of a comparatively small number of unmeasured, generally undated and frequently imperfectly localised skins, with skulls to match.

For the identification of the old collection, including Hodgson's Nepalese specimens, Gray was responsible till 1869 when his Catalogue appeared. Blanford attempted a revision of Gray's results in 1885 and 1888; and in the early years of the Survey all the specimens in the Museum at that time were examined and most of them identified by Schwarz. Finally Wroughton, with most of the Survey material in his hands, published in 1917 brief diagnoses of the species he considered valid; and Fry determined subsequent additions from Wroughton's paper. My conclusions set forth in the following pages differ very materially from those of my predecessors, especially, I regret to say, from Blanford's.[1]

The Palm Civets here dealt with are the dominant members of a compact subfamily of the *Viverridae*, the *Paradoxurinae*, which comprises in addition the Binturong (*Arctictis*) and a rare genus from Celebes, *Macrogalidia*. They differ essentially from the Civet Cats or *Viverrinae*, described in my previous paper (*Journ. Bomb. Nat. Hist. Soc.*, xxxvi, pp. 423-449 and pp. 629-656, 1933), in being short-legged, more plantigrade species, adapted to scansorial habits with well developed pads behind the plantar pad on the feet for grasping the branches of trees after the manner of bears. The perfume glands also are very differently and less elaborately constructed, consisting in the male of a large area of naked skin in front of the scrotum and surrounding the prepuce in front and in the female of a similar but smaller naked area with the vulva near its centre.

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[1] Even with the small amount of material at his disposal Blanford made many puzzling mistakes. His statement that the South Indian Palm Civet, he named *niger*, has no pattern, when there were specimens in the Museum showing it very manifestly, is a case in point. But a perusal of his monograph of 1885 enforces the conclusion that his disapproval, if not personal dislike, of Gray biased his judgment, urging him to set aside on any pretext the conclusions of that author, an earlier reviser of the group, even when probably correct. Gray, for instance, rightly in my opinion, assigned the name *hermaphroditus* to the common South Indian form. But Blanford, for no good reason, transferred it to the Malayan and Sumatran form and his decision on that point has been accepted to the present time.

The two genera *Paradoxurus* and *Paguma* may be at once distinguished by the following cranial characters:—

a. Skull of adult, especially of the male, deeply constricted behind the frontal or postorbital processes forming a conspicuous 'waist' narrower than the interorbital area and abruptly expanding into the swollen part of the cranium behind it; palate only produced to a comparatively small extent beyond the teeth; the mesopterygoid area relatively much longer and narrower ... *Paradoxurus*.

a'. Skull without pronounced constriction behind the postorbital processes, the 'waist' about as wide as the interorbital area and gradually expanding into the cranium behind it; the palate considerably produced beyond the last molar; the mesopterygoid area relatively short and broad ... ... *Paguma*.

Genus: PARADOXURUS, Cuv. & Geoffr.

Paradoxurus, F. Cuvier & Geoffroy St. Hilaire, *Hist. Nat. Mamm.*, pt. xxiv, p. 5, 1821 (type *typus* Cuv. & Geoffr. = *hermaphrodita*, Schreber).

Platychista, Otto, *Nov. Act. Acad. Caes. Leop.*, xvii, p. 1089, 1835; Gray, *Proc. Zool. Soc.* 1864, p. 531, (type *pallasi* Otto = *hermaphrodita*, Schreber).

Bondar, Gray, *Proc. Zool. Soc.* 1864, p. 531, (type *bondar Desm.*).

Macrodus, Gray, *Proc. Zool. Soc.* 1864, p. 536, (type *macrodus* Gray).

Distribution: Ceylon, Peninsular India, the Himalayas from Kashmir to Assam, thence eastwards and southwards to China and throughout the countries and islands of S.-E. Asia as far as the Philippines, Borneo and the Moluccas.

It is needless to repeat the characters of this genus given above; but the systematic part of the paper may be preceded by some observations of general interest on the skins and skulls of the British Indian races mainly collected by the Survey.

THE COAT-CHANGE, ITS DATES AND EFFECTS.

The coat-change has a profound effect upon the general appearance of the skins, in some races more than others, and has been the cause apparently of erroneous identification of specimens and of confusion in synonymies. The coat consists of two elements, shorter underwool of varying length and long stiffer hairs always longer than the wool and when the latter is short lying smoothly over it and concealing it. These longer hairs, when fresh and unbleached, are black to a very variable extent at the tip, sometimes throughout, but most of them are pale below the tip, the pale portions being very frequently crinkled or wavy and hardly distinguishable from the underwool where they emerge from it.[1] The pale areas of the long hairs and the outer portion of the wool may vary individually in the same race from silvery grey to ochreous buff; but on the back and flanks there are typically definite areas where the hairs and the wool are blackish throughout. These dark areas stand out as a pattern of black stripes on the back and of spots on the flanks, sometimes also on the thighs, shoulders and nape, in contrast to the pale or coloured areas which separate or surround them. But the contrast is sometimes superficially dimmed, in rare cases nearly entirely obliterated, when the hairs of the intervening spaces have the tips so extensively blackened as almost to conceal the light areas below. In one race, identified as *bondar*, the pattern of the complete winter coat may be purely superficial and formed by the linear confluence of the black tips of the long hairs so that it is readily disarranged.

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[1] In the measurements of the coats given below, always in millimetres, the approximate mean length of the hairs is taken, not the length of the very longest, from the skin; the wool is similarly measured from the skin approximately to the distal portion of the pale areas of the hairs, although the wool itself does not in all cases reach that level.

The pattern is most in evidence in specimens in which the long hairs have been moulted and the skin is covered with a new coat of short, soft hair. Specimens undergoing coat-change are very difficult to determine because the colour, pattern and texture of the coat all alter; but the Survey fortunately procured in most instances skins from different localities in complete coat, enabling me to make use of the winter pelage as a distinguishing racial character.

Both the underwool and the hairs are moulted, but not simultaneously. There is, however, no available series of skins collected in one district throughout the year to show the precise details and sequence of the coat-changes and the months of their incidence; and there are still many puzzling features connected with the phenomenon. All that can at present be stated is that as a general rule 'summer' skins collected from May to October are in poorer coat than those collected in December and March, and that in March the coats are usually at their best and begin to deteriorate in the following month, although the long hairs of the winter coat, harsh and often faded, may persist till summer is well advanced.

Phases of the moult are exhibited by the following specimens:—

1. Singar Gaya, 1,400 ft., in the Patna Division of Bengal, May 21 (Crump). The coat on the back consists in the main of only long, coarse hairs, the underwool being negligible in quantity, just sufficient to show faint traces of pattern here and there; on the tail, however, the long hairs have mostly disappeared except at the base and tip, the rest being clothed with short, smooth, apparently new hair. This skin shows that the underwool is moulted before the long hairs of the winter coat are shed.

2. Kangra, 2,000 ft., skin of an adult ♀, dated March 28 (Wells). The neck, shoulders and fore-back are clothed with a short, close coat of soft greyish-white new hair showing a very distinct normal pattern at the base of the scanty long hairs which still persist on these areas; but on the hind-back and rump there is practically no underwool and the long hairs are here more abundant than forwards. This skin seems to represent the phase of coat-change succeeding the phase represented by the skin from Singar Gaya; but the date must, I think, be wrong especially as a number of additional skins from Kangra, all dated March, are in full winter coat.

3. Nepal Tarai. An undated skin, the type of *strictus* Horsfield, apparently exhibits a stage following that of the Kangra skin. The whole of the dorsal surface is covered with short, close, soft grey hair with a strongly contrasted pattern, a few long, coarse, dead and partly bleached hairs still being in place on the neck, shoulders, hind-back and rump.

4. Skins from Guna in Gwalior, October 26; Makut, S. Coorg, January 11; Udugama, S. Ceylon, April 28; and Madras, undated, are in general appearance very like the skin from Nepal, except that the long hairs are more abundant on the fore-quarters and the short, soft coat is longer on the hind-back and rump, where there are practically no long hairs, the pattern here being strongly pronounced.

5. Bahgownie in Darbanga, Upper Bengal. One skin, July 28, has the coat composed mostly of long greyish white wool, with the long coarse hairs considerably thinned out, especially on the neck, shoulders and rump, the pattern being rather obscure. Another, September 6, is very similar in appearance but the long hairs are apparently new, being shorter and softer.

6. Sagaing in Upper Burma, July 9 and 13, three skins with the underwool scanty or absent but the long hairs, apparently of the winter coat,

retained mostly but moulted in one skin on part of the fore quarters which is clothed with soft new grey fur showing the pattern.

THE BREEDING SEASON.

The record by Taylor of a kitten, supposed to be a month or two old but still with its mother, being brought to him in Khondmals in May suggests that it was born in March or April; but the skins of several adult females in the British Museum attest by the appearance of the mammary areas, the teats being large and isolated by the nakedness of the surrounding skin, that the young are suckled between the autumn and the spring. The dates and localities of these skins are as follows:—September 15, Rajputana; Dharwar, November 3 and December 8; S. Coorg, January 11; N. Kanara, February 9; Hazaribagh, March 8; Kangra, March 28. On the other hand adult or nearly adult female skins collected on April 30, S. Ceylon, on July 25 and 27 and August 25 in the Eastern Ghats, show no indication of suckling young, the teats being small and concealed by hair. But in the case of the Burmese race a skin from Lower Chindwin, June 4, and three from Sagaing, July 9 and 13, attest suckling of young in mid summer. Possibly there are two litters in the course of the year.

All the above mentioned females have three pairs of teats and I have never succeeded in finding more or fewer than that number in *Paradoxurus* despite Hodgson's statement that a female he named *hirsutus* had only two pairs, like *Paguma*. The anterior pair, however, is always the smallest and often difficult to detect. Probably Hodgson overlooked it.

AGE AND ORDER OF THE TOOTH-CHANGE.

As in other members of the *Viverridæ*, the milk-teeth of the Palm Civets are retained until the animal has reached almost full size. An example of this is supplied by the specimen, collected at Mingun near Mandalay by Major Harrington, of which the flesh and skull measurements are given below. That the change sets in eight or nine months after birth is suggested by the skull and by Mr. J. Taylor's account of the type of *nictitans*, which was brought to him as a kitten in May 1891 at Khondmals in Orissa, when it was judged to be a month or two old. He kept it alive for seven months, until November. Its skull in the British Museum is only 10 mm. shorter in condylo-basal length than the skull of an almost adult ♂ from the same locality. It has its full complement of milk-teeth except that pm^2 of the upper jaw has been pushed out by the corresponding tooth of the permanent set of which nearly the entire crown projects beyond the bone. The only other tooth of the permanent set exposed is m^1 of the upper jaw of which the entire crown, but not fully erupted, is displayed behind pm^4 of the milk set. The shedding of this latter tooth was, however, imminent. In the lower jaw the teeth are more backward, none of the permanent set being up, m_1 has split the bone although it was still covered by gum, and the point of pm_2 is just showing beneath the corresponding milk tooth. From these facts it seems probable that the tooth-change in *Paradoxurus* is completed when the animal is about a year old.

A young skull from Tenasserim is in exactly the same condition as regards the tooth-change of the upper jaw as the skull from Orissa; but the lower jaw is more advanced, pm_2 being fully up and m_1 just through the bone. From the skulls examined, it seems that pm^2 and m^1, above and below, are the first of the permanent set to come into use; of the premolars upper pm^3 and lower pm_4 are the last to cut; lower m_2 is a little behind or a little before pm_4 and upper m_2 is the last of all to appear.

DESCRIPTIONS OF THE SPECIES AND SUBSPECIES.

The three species of *Paradoxurus*, here admitted, inhabiting British India, may be distinguished as follows:—

a. Hair on neck reversed in growth directed forwards up to the head; pattern absent or evanescent.

*a*¹ A little smaller, colour paler brown to greyish brown, facial vibrissæ buffish white; skull with smaller teeth and short prepalatine foramina ... *zeylonensis.*

a^1. A little larger; colour dark brown to grizzled black, vibrissæ black; skull with larger teeth and exceptionally long prepalatine foramina ... *jerdoni.*

b. Hair on neck normal in growth, directed backwards; pattern typically strongly pronounced; prepalatine foramina not lengthened ... ... *hermaphroditus.*

PARADOXURUS ZEYLONENSIS, Schreber.

Viverra zeylonensis (Pall.) *Schreber, Säug.*, iii, p. 451, 1777; changed to *zeylanica* by Gmelin, *Syst. Nat.*, ed. xiii, i, p. 89, 1788.

Paradoxurus zeylanicus, Kelaart, *Prodr. Faun. Zeylon.*, p. 39, 1852; Blyth, *Journ. As. Soc. Beng.*, xx, pp. 161 and 184, 1852.

Paradoxurus zeylonensis, Blanf., *Proc. Zool. Soc.* 1885, p. 612.

? *Paradoxurus aureus*, Cuvier, *Mém. Mus. Hist. Nat.* ix, p. 48, pl. 4, 1822; Blanf., *Proc. Zool. Soc.* 1885, p. 782, id. *Fauna Brit. Ind., Mamm.*, p. 110, 1888; and of subsequent authors.

Paradoxurus zeylanicus var. *fuscus* or *montanus*, Kelaart. *Prodr. Faun. Zeylon*, p. 40, 1852; *montanus*, Blyth, *Journ. As. Soc. Beng.*, xx, pp. 161 and 184, 1852.

Locality of type of *zeylonensis*, Schr. (=*zeylanica* Gm.): Ceylon.

Locality of type of *aureus*, Cuvier: unknown.

Locality of type of *fuscus* or *montanus*, Kelaart: Newera Eliya, Ceylon.

Distribution: Ceylon; said to be found only in the hills.

Note on the synonymy. The original specimen of this species was from Ceylon as recorded by Pallas, who sent the description of it to Schreber for publication. Gmelin epitomised this description but altered the name to *zeylanica*, this inadmissible emendation being accepted by Kelaart and Blyth. In June 1885 Blanford adopted Kelaart's decision, but quite rightly took Schreber's older name and quoted the species as *Paradoxurus zeylonensis*. Five months later, however, he changed his opinion because Schreber's description did not exactly fit the specimens with which he was acquainted. He candidly admitted being unable to say to what Ceylonese Carnivore the description of *zeylonensis* applied, if not to the Brown Palm Civet; but he evaded that difficulty by assuming the locality to be wrong, and chose Cuvier's name *aureus* based on a young specimen from an unknown country! It is not unlikely that Cuvier's specimen came from Ceylon, although the only young example of the Brown Ceylonese species I have seen is brownish grey not golden brown like Cuvier's. I can find no good reasons for dissenting from Kelaart's identification of this species. Pallas described his specimen as grey overspread with brown, paler below, blackish on the hinder part of the back and tail, the vibrissæ being white. This description does not suit the few examples in the British Museum at the time Blanford wrote his revision of the Palm Civets in November 1885 and summarised in his volume in 1888; but specimens subsequently procured through the Survey show that the colour is much more variable than Blanford's descriptions suggest, varying, as enumerated below, from grey tinged with brown to a deep rich brown, with sometimes a dark blackish tinge on the back and upper side of the tail.

The name *fuscus* (*montanus*) was given by Kelaart to a supposedly darker variety from Newera Eliya.

Description: The hair in front of the shoulders radiating from two whorls and growing forwards along the nape and sides of the neck to the head; on the throat also it grows forwards, radiating from a single median whorl. General colour above usually tolerably uniformly paler or darker brown, with the pattern on the back obsolete or represented by faint stripes and spots on the body; the limbs much the same tint as the body, the belly a little paler, the tail and face noticeably paler buffy grey and the face without grey markings; the vibrissae dirty white. Occasionally, perhaps always in young specimens, grey is dominant over the brown even on the upper side.

The following skins are in the British Museum:—

1. An adult ♀ from Newara Eliya (Kelaart, No. 520. 5. 9. 18) is tolerably uniformly ochreous or golden brown above, a trifle paler below but with the tail and face noticeably greyer, the cheeks buffy grey, the vibrissae dirty white; a few stripes on the back just traceable; the coat is full and moderately long.

2. A younger unsexed specimen from the same locality and donor (No. 52. 5. 9. 17), the type of *fuscus* (*montanus*), is very like the last but has the coat longer and is decidedly darker, a deeper, more rusty brown with pattern not traceable. In these two skins the younger is the darker of the two, whereas, according to Blyth who had two living examples received from Kelaart, the colour gradually darkened with age.

3. 'Ceylon' (White, No. 77. 11. 1. 3.) Adult ♂, not so full in the coat as Kelaart's specimens and less richly tinted than the paler of the two, the flanks especially being greyer; and the pattern slightly better defined; the tips of the long hairs of the upper side greyish buff and lustrous.

4. The same history (No. 77. 11. 1. 4.). A subadult ♂, a little paler than the last.

The difference in tint between Nos. 1 and 4 is very marked, ranging from rather rich ochreous brown to buffy brown; but the gradation between them supplied by 2 and 3 is complete.

5. A young ♂ from Mousakande, Gammaduwa, 3,000 ft., C.P., September 24 (W. W. A. Phillips; No. 27. 11. 28. 1), has a thicker, softer coat than the others and is darker even than No. 1, the deep brown hue being more sepia in tint and less rusty or ochreous, the hairs of the flanks having lustrous tips, while those of the back have very deep brown tips especially on the croup whence a sharply defined dark band runs along the summit of the tail, the lower side of the tail being noticeably grey and the belly greyer than in Nos. 1 to 4.

6. An immature specimen with the same history (No. 27. 11. 28. 2) is grey with a brownish tinge above and quite grey below. Except that this specimen does not exhibit the 'blackish' hairs on the hind-back and tail, it agrees closely in colour with Schreber's description of the type of *zeylonensis*. But the older specimen, No. 5, from the same locality is noticeably more heavily pigmented on those areas.

7. An adult ♀, the condition of the three pairs of teats suggesting the weaning of young, from Maha Oya, E. P., August 12 (E. W. Mayor), has apparently a somewhat faded coat, as if the moult was imminent, dull greyish brown without any rufous, ochreous or buff hue and the belly is greyer than in Kelaart's and Whyte's specimens. The tail has a white tip and there is a white patch on the hind-belly.

8. An adult ♂ from Lipton's Tea Estate, Koslanda, S. Ceylon (W. P. Lowe), March 25, is intermediate in tint between the dark brown Gammadum and the pale brown Maha Oya specimens but the tail becomes gradually whiter from the base to the point and the coat is fuller and larger than in the example from Maha Oya, about 38 mm.

The flesh-measurements in English inches and the weights of this specimen and of the larger sent by Phillips are entered in the following table with the data supplied by Kelaart:—

Locality and Sex.	Head and Body.	Tail.	Hind Foot.	Weight.	Coat.
Ceylon (Kelaart) ♀ ...	19	15½	...	...	30 mm.
Newera Eliya *fuscus* ...	19½	17	...	...	43 mm.
Maha Oya. E.P., Aug. 12, ad. ♀ ...	20 +	18	2⅘	4 lbs.	27 mm.
Gammaduwa, C.P., Sept. 24, yg. ♂ ...	19 –	18 +	3 –	4 lbs. 6 ozs.	29 mm.

Of the skulls represented by the skins above described, one of the two received from Kelaart consists of the jaws only and is that of an old female with the teeth much worn; the other, the type of his var. *fuscus* or *montanus*, is immature. Of the two collected by Whyte, one (No. 77. 11. 1. 3) is fully adult, but is obviously rickety and belonged no doubt to a specimen reared in captivity; the other (No. 77. 11. 1. 4.), entered below, is a young adult ♂. The skull of Mr. Phillips' well coloured example from Gammaduwa is ♂ but not adult; the other is quite immature.

Finally, the skull procured by E. W. Mayor at Maha Oya is that of a just adult ♀.

The following are selected for measurement[1]:—

Locality and Sex.	In English Inches.					In Millimetres.		
	Total length.	Zygom width.	Waist width.	Int. orb. width.	Max. width.	Bulla.	Pm^4.	M^1.
Ceylon (Whyte). yg. ad. ♂ ...	4·2	2·3	·4½	·7	·8	17	7½ × 5½	5 × 7
Newera Eliya (type of *montanus*), yg. ♂ ...	3·8½	1·9	·5½	...	·7 +	...	8 × 7	6 × 8+
Gammaduwa, C. P. yg. ♂ ...	3·7	2·0	·5	·5½	·7	16½	8½ × 6	6 × 8
Maha Oya, E. P., just ad. ♀ ...	4·0	2·1	·5	·7	·7	15	7 × 6	5½ × 6
Koslanda, S. P., ad. ♂ ...	4·1	2·1+	·5	·7	·7 +	—	7½ × 6	6 × 8

An interesting point connected with this table is the variations in the size of the teeth. The first and last skulls on the list are practically full sized. The postorbital processes are small in both but both have a complete low sagittal crest.

The data are unsatisfactory. They show, however, that the teeth are smaller than in the next species, *jerdoni*, that the single adult ♀ skull is decidedly smaller than the old ♀ skull of that species from the Nilgiri Hills, and that the young adult ♂ is also decidedly smaller than the young adult ♂ from Trivandrum, although subequal to the one from the Palni Hills. The measured teeth, pm^1 and m^1, it may be added, have their inner lobes more robust and less constricted than in Ceylonese and Indian examples of *hermaphroditus* and in this respect are more like those teeth in the large Burmese race *ravus*.[2]

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[1] The skull-measurements in this paper are as follows:—'*Total length* from the occipital crest to the edge of the premaxillae; *zygomatic width* across the arches at their widest point; interorbital width the same in front of the postorbial processes; *maxillary width* the muzzle just above the canine teeth; *bulla* the length of the inflated portion (entotympanic bone) including the paroccipital process which clamps it behind; pm^4 the large upper carnassal tooth along its outer edge and across its anterior portion; m^1 the large tooth behind it along its outer edge and across its middle.

[2] There are three skulls in the British Museum (Nos. 1036, b, c, d) named *P. aureus* and received from the Zoological Society's Museum in 1855 and 1858, without locality and without names, except that one is entered in the register as *Genetta*. These are probably the skulls Gray referred to in his Catalogue as possibly substantiating Kelaart's claim to the occurrence of two varieties of this species in Ceylon. On the label of one of them Schwarz endorsed its identification as *aureus*. I can find no reason for thinking they belong to that species.

PARADOXURUS JERDONI, Blanf.

Paradoxurus jerdoni, Blanford, *Proc. Zool. Soc.* 1885, p. 613 and p. 802, pl. 49; also 1886, p. 420; and of subsequent authors.

Locality of type: Kodaikanal in the Palni Hills.

Distribution: Southern India from Coorg to Travancore and eastward to Madura.

Description: Resembling the Ceylonese species, *P. zeylonensis*, in the reversal in growth of the hairs on the neck and throat but a little larger and, although sometimes very similar in colour, usually considerably darker and either deep brown all over or brown or black with the back and flanks speckled with silvery or buffy grey; the dorsal pattern is only occasionally just traceable and the vibrissae are blackish, not rufescent as in *zeylonensis*.

Skull a little larger with markedly larger teeth, when unworn, and with much longer anterior palatine foramina which extend backwards beyond the posterior edge of the upper canines. In the length of these foramina *P. jerdoni* differs from all the other species of *Paradoxurus;* but the length varies in adult skulls from 8 to 11 mm., being usually 9 mm., and shortens with age. In a very old skull, with the teeth much worn, from Kateri in the Nilgiri Hills, the length is only 6½ mm., whereas in a young skull 21 mm. shorter in total length, from Haleri, N. Coorg, the length of the foramina is 7 mm. In other species, *hermaphroditus* and *zeylonensis*, the foramina extend back approximately to the middle of the canines and are from about 4 to 6 mm. long, varying in length individually within subspecific limits (Fig. 2, A, B, p. 953).

Judging from the skins in the British Museum there appear to be two distinguishable races of this speces differing as follows:—

a. Face uniformly coloured or with faint traces of grey-tipped hairs; less grey on the body ... ... *jerdoni*.
b. Face with distinct grey pattern; more grey-tipped hairs on body ... ... *caniscus*.

Subsp. *jerdoni*, Blanford.

Bibliographical references as above.

The type of this subspecies is a skin and skull in the British Museum from Kodaikanal in the Palni Hills; but the skin is practically denuded of hair by moth, as recorded by Blanford who took his description and illustration from an example collected by F. Day probably in the Animallai Hills. Fortunately Mr. C. McCann collected for the Survey three adult examples in the Palni Hills, which enable the race to be adequately described. Their characters are as follows:—

Adult ♀, topotype of the race from the Pamber River, Kodaikanal, 7,000 ft., May 16. The colour is uniformly dark glossy brown all over, with some faint buffy speckling but no pattern and the underwool is dark grey; the coat is long and thick.

Adult ♂ from Tiger Shola, 5,600 ft., April 22. Differs from the last in having the head, forequarters and limbs blackish brown, and the back behind the shoulders, the flanks and belly speckled with clear grey, the base of the hairs on the proximal half of the tail brownish grey and a few grey-tipped hairs in front of the ears with slight indications of grey speckling on the forehead and below the eyes.

Adult ♂ from the same locality, 5,700 ft., April 27, is like the last but rather more profusely grizzled on the body, with the base of the hairs on the proximal portion of the tail yellower brown and a small white tip to the tail.

The difference in colour between the uniformly brown female and the two grizzled males is striking. It is probably an individual variation and not a seasonal or sexual phase.

The following specimens are also assigned to this race:—

? Animallai Hills. F. Day's specimen, figured by Blanford, resembles McCann's examples from Tiger Shola in the Palni Hills, but the dorsal pattern is faintly traceable.

Wellington in the Nilgiri Hills, December 11 (*Capt. Sapte*). An unsexed but probably male specimen is like McCann's female topotype in being a uniform deep brown hue but the colour is a rather richer brown, the underwool greyer and the coat, doubtless in accordance with the season, is considerably fuller, 40 mm. long.

Kateri in the Nilgiri Hills (*G. F. Hampson*). An old ♂, undated, differs from the last as the female from the Palni Hills differs from the males, the back and flanks being distinctly speckled; but the speckling is buffy grey not clear grey as in the Palni Hills males and the head and forequarters are browner.

These two examples from the Nilgiris are decidedly lighter brown even than the brown Palni Hills specimen and not black like the males.

Travancore, northern end of the Range (*H. S. Ferguson*). A male, January, hardly differing from the example from Kateri in the Nilgiris, except that the buffy speckling is noticeably less conspicuous; the coat is shorter, about 35 mm.

Travancore, Trivandrum (*H. S. Ferguson*). A flat imperfect female skin is dominantly buffy grey and more extensively and profusely speckled than any of the previously described skins, the speckling extending over the shoulders on to the neck, but it is not so clear grey as the examples from Tiger Shola.

? Travancore. An aberrant skin of a specimen that died in the Trivandrum Zoological Gardens I regard as a rufescent variety of this race. It is bright, rather reddish brown in hue, has a clearer reddish tip to the tail and reddish vibrissae. In tint it is more like a well coloured specimen of the Ceylon species than any of the specimens of *jerdoni* described; but if it were *zeylonensis* the vibrissae would be white.

The variations in hue of the specimens above described is considerable. Those from the Palni and presumably Animallai Hills are alike and differ somewhat from the Nilgiri and northern Travancore specimens which are also alike. The one from Trivandrum is different from both sets. More than one race may be involved but the skins are inadequate to settle that question. At all events the skins assigned to this race agree and differ from the following in the suppression, complete or almost so, of facial pattern.

Subsp. *caniscus* nov.

Locality of type: Virajpet in S. Coorg.
Distribution: Coorg, so far as at present known.

Description: Distinguished from typical *jerdoni* by having the grey and black facial pattern as well developed as in some Indian examples of *P. hermaphroditus* and consisting of a large grey patch in front of the ear separated by a black streak from a similar patch below the eye; also a grey patch above the eye and conspicuous grey speckling on the brow, the greyness combining to define the blackness of the crown of the head. There is also a little more greyish white speckling on the back, flanks and belly and more white on the hairs of the tail, although this feature intergrades with typical *jerdoni*.

This race is represented by three skins:—

♂ (type) from Virajpet in S. Coorg, 3,000 ft. (*G. C. Shortridge* No. 13.8.22.23 and 2449), January 29. Characters as above described with the hairs on the basal half of the tail about the same tint as in the palest tailed specimen of *jerdoni* from the Palni Hills.

♀ same locality and history (No. 13.8.22.24 and 2430). January 28. Like the ♂ but with the hairs on the basal half of the tail paler, dirty white.

♂ (young), Haleri, N. Coorg (*J. A. Graham;* No. 3555). Differs from the Virajpet specimens in having the back, flanks and belly considerably more profusely speckled with grey and much more white on the tail which is mainly white with a black dorsal stripe and black tip.

The following particulars regarding the size of the two races here admitted, apparently the only ones available, were recorded by the Survey collectors:—

Locality, Sex and Date.	Head and Body.	Tail.	Hind Foot.	Weight.	Coat.
jerdoni					
Tiger Shola, Apr. 22, ad. ♂	23⅕	21	3½	8 lbs.	43 mm.
,, Apr. 27, subad. ♂	22⅕	19⅕	3⅖—	6 ,,	41 ,,
Kodaikanal, May 16, ad. ♀	21⅗	17⅗	3 +	...	42 ,,
caniscus					
Virajpet, Jan. 13, ad. ♂	24	21	3⅗	9½ lbs.	35 mm.
,, Jan. 13, ad. ♀	22⅘	21	3⅖	5½ ,,	35 ,,
Haleri. Feb. 28, immat. ♂	17	17⅗	3⅕	...	37 ,,

This table shows no difference in size between the two races but suggests that *caniscus* has a shorter coat.

The following skulls have been selected for measurement to show the range in variation:—

Locality and Sex.	In English Inches.					In Millimetres.		
	Total length.	Zygom. width.	Waist width.	Int. orb. width.	Max. width	Bulla.	Pm^4.	M^1.
jerdoni								
Palni Hills (type). ad. ?♂	4·5	2·4½	·5	·8½	·8	17	9 × 6½	7 × 9
Khukal, Palni Hills. ad. ?♂	4·4½	2·6	·5	·8	·8	15	9 × 7½	7 × 9
Tiger Shola, ,, yg. ad. ♂	4·2	2·2	·5	·8	+ ·8	17	10 × 7	7 × 9
Kateri, Nilgiri Hills. old ♂	4·5	2·5	·5-	·8½	·8½	16	7½ × 6	6 × 8
Pamber River old ♀	4·3	2·4	...	·8	·8	15	9 × 7	7 × 8½
Trivandrum, yg. ad. ?♂	4·5	2·5½	·5	·8	·8½	18	9 × 7½	7 × 9
caniscus								
Virajpet (type). ad. ♂	4·4	2·4–	·5	·8	·8	17	9 × 7½	7- × 9
Virajpet, yg. ad. ♀	...	...	...	..	...	...	8 × 7	...
Haleri, immat. ♂	3·7	1·9½	·5	·7	·7	14	...	...

These measurements supply no evidence of cranial or dental differences between the two races. Of the skulls assigned to typical *jerdoni* only two are sexed, namely the ♂ from Tiger Shola and the ♀ from the Pamber River, both collected by Mr. McCann, who also secured the skull from Khukal in the Palnis, but this had no skin. The sexes of the other skulls have been guessed from their characters. The only parts of the skull that vary noticeably are the bulla and the teeth. The effects of wear on the teeth with age is shown by the skull from Kateri in the Nilgiris, in which they are reduced to approximately the same size as the newly erupted, unworn teeth of the young ♂ of *P. zeylonensis* from Gammadum. In the other skulls the teeth, especially the first upper molar, are larger than in the Ceylon species. The skull also is a little larger, but not very much although the old ♀ of *jerdoni* from the Nilgiris noticeably exceeds the adult ♀ of *zeylonensis* from Maha Oya.

The measurements of the immature ♂ skull of *caniscus* from N. Coorg have been inserted for comparison with those of the young ♂ skull of *P. zeylonensis* from Gammadum. The dimensions agree very closely; but the skull from Coorg carries its milk teeth with no sign of shedding, whereas the skull from Gammadum has the permanent cheek teeth fully erupted.

PARADOXURUS HERMAPHRODITUS, Schr.

The principal characters of this species are given above.

The bibliography is included under the subspecific headings.

Distribution: From Ceylon and India eastwards to Borneo and the Philippines.

PARADOXURUS HERMAPHRODITUS HERMAPHRODITUS Schr.

Viverra hermaphrodita (Pallas) Schreber, *Säugeth.*, iii, p. 426, 1778.

Paradoxurus hermaphroditus Gray, *Proc. Zool. Soc.* 1864, p. 532 (not of Blanford 1885 and 1888 and recent authors).

Viverra nigra, Desmarest, *Mamm.*, p. 208, 1820 (not *Viverra nigra*), Peale and Beauvois, 1796; (see Hollister, *Proc. Biol. Soc. Wash.*, xxvii, p. 215, 1914).

Paradoxurus niger, Blanford, *Proc. Zool. Soc.* 1885, p. 792 and *Mamm. British Ind.*, p. 106, 1888 (in part); Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxv, pp. 48-51, 1917.

Paradoxurus typus, F. Cuvier and Geoffroy, *Hist. Nat. Mamm.*, pt. xxiv, p. 5, pl. 186, 1821; and of many subsequent authors; Robinson and Kloss, *Rec. Ind. Mus.*, xix, p. 178, 1920 (as subsp. of *hermaphroditus*).

Paradoxurus typus var. *fuliginosus*, Gray, *Proc. Zool. Soc.* 1832, p. 65.

Platychista pallasii, Otto, *Nov. Act. Acad. Caes. Leop.*, xvii, p. 1089, pls. 52-53, 1835 (not *P. pallasii*, Gray, 1832).

Paradoxurus felinus, Wagner, *Suppl. Schreb. Säugeth.* ii, p. 349, 1841.

Locality of type of *hermaphrodita*, Schreb.; unknown, said to be 'Barbary'.

Locality of type of *nigra*, Desm.; Pondicherry.

Locality of type of *typus*, Cuv. & Geoffr.; Pondicherry.

Locality of type of *fuliginosus*, Gray; 'S. India'.

Locality of type of *pallasii*, Otto; unknown.

Locality of type of *felinus*, Wagner; unknown.

Distribution: Southern India, southwards from the Narbada River, and Ceylon.

Notes on the Synonymy.

In 1864 Gray adopted the name *hermaphroditus* for the common Palm Civet of Ceylon and Southern India. Blanford in 1885 rejected this view and applied the name to a so-called species ranging from the Himalayas through south-eastern Asia. In my opinion Gray was right. At all events the Palm Civet to which *hermaphroditus* was first given was described as having long hair, grey near the skin and black at the tips, the black being dominant; there were three black dorsal stripes and the only facial pattern mentioned was a light grey rim in front of the ears. As a brief diagnosis this terminology could hardly be improved for the majority of specimens from Southern India; but I cannot believe that Pallas would have described in those terms any example of the comparatively short coated Sumatran and Malayan forms to which the name *hermaphroditus* has been restricted by recent zoologists, following Blanford's lead. The name for this form is *musanga*. The name *niger*, which Blanford and, following him, Wroughton, applied to the Ceylonese and Peninsular Indian Palm Civets is in any case inadmissible because, as pointed out by Hollister, *Viverra nigra* was given to an American skunk many years before Desmarest gave it to a Palm Civet from Pondicherry. After Hollister published this discovery, Robinson and Kloss resuscitated for the Palm Civets in question the name *typus* given by Cuvier to a specimen from the same locality and source as Desmarest's *nigra*. But *hermaphroditus* is an older name than *typus;* and in connection with the allocation of *hermaphroditus* here adopted, it is significant that Desmarest himself, although setting that name aside as indicating an insufficently characterised species, astutely detected that 'when established it should take place alongside' his *Viverra nigra*—not, be it observed, alongside his *Viverra bondar*.

Gray introduced the name *fuliginosus*, omitted by Blanford, for blackish S. Indian specimens; and *pallasii* and *felinus*, given to specimens from unrecorded localities, were apparently correctly regarded by Otto and Wagner respectively as synonyms of *hermaphroditus*. Blanford seems to have agreed with Otto in this matter.

Description: Distinguished in complete coat by the shortness and thinness of the pale woolly under hair as compared with the long hairs, and by the excessive elongation of the black tips of the latter, which more or less mask the pattern by overlying and obscuring the pale interspaces between the stripes and spots; the colour of the interspaces usually grey, sometimes decidedly buff, very rarely rich ochreous buff, varying individually in specimens from the same locality. The black pattern of dorsal stripes, with usually later spots, present but very variable in conspicuousness according to the season, boldly pronounced when the long black tipped hairs are thinned or absent owing to the moult.

In the following notes on the skins in the British Museum, the specimens are arranged geographically, approximately from south to north, beginning with Ceylon.

Specimens from Ceylon: Only a few skins are available and those that are dated, four in number, were collected by Major E. M.

Mayor, between April 28 and May 2. Hence there is no proof that any of them is in complete coat. The colour is individually very variable. In a young adult ♂, ticketed 'Ceylon' (Colombo Museum) the colour is dominantly black, the grey of the under hair showing as irregular streaks where it is not concealed by the black tips of the abundant longer hairs; the brow band is represented by small grey speckling. From the general condition of the coat and the profuseness of the long black hairs, this skin appears to be in complete coat. A ♀ from Kandy (Whyte) has the ground colour grey as in the last, but the coat is thinner and the long blacktipped hairs less abundant on the dorsal side, so that the grey ground tint is much more exposed and the pattern better defined; the brow band and sub-ocular spot are also more evident. An adult ♂ from Tammanewa, N.C.P., May 2, has the coat in good condition, the ground colour buffy-white and exposed on the sides of the dorsal surface and flanks where the long black tipped hairs are apparently moulted; black is dominant along the middle of the back and the pattern consists of the normal stripes and spots.

A young ♂ from Nakiyadenyia, S.P., April 28, closely resembles the last in coat, colour and pattern.

An adult ♀ from Udugama, S.P., April 30, differs principally from the last two in having the ground colour rich, almost ochreous buff and the face mostly white owing to the large size of the nasal and subocular spots and the inconspicuousness of black on the brow-band.

A young ♂ from Udugama, April 30, is the same general colour as the ♀, but the moult is more advanced, the coat being shorter, and the long hairs mostly gone from the hind back and loins, the pattern here being strongly defined.

Specimens from Madras and the Eastern Ghats: Seven skins from South-Eastern India are of some importance from the practical certainty of their racial identity with the specimens named *niger* and *typus* by Desmarest and Cuvier. An adult ♂, from Madras (*Jerdoni*) is very similar in coat and pattern to the ♂ skin from Udugama; but the moult is still more advanced and the general tint duller, not so yellow, looking like faded buff.

Six specimens from the Ghats were collected by Baptista who recorded the dates, flesh measurements and weights. They vary similarly to the Ceylonese series.

Dharmapuri Range, N. Salem. A ♀ from Hogainakal, 850 ft., August 25, has the coat in good condition, long but not thick; the ground tint is whitish grey with a faint tawny wash on the spine; the dorsal surface is a tolerably even mixture of black and grey, without any distinct pattern.

A ♂ from Nagampatti, 1,650 ft., September 13, is almost a duplicate in colour and coat of the example from Tammanewa in Ceylon, the colour being buffier grey and the pattern more distinct than in the specimen from Hogainakal, with the coat a little fuller.

Denkanikota Range, N. Salem. A ♂, from Aiyur, 3,062 ft., October 18, has the coat thinner and shabbier than in the other Salem specimens and the colour richer buff like the Ceylonese skins from Udugama.

Palkonda Hills in S. Cuddapah. A ♂ from Balopalli, 1,000 ft., August 11. The coat is long, thin and harsh, with much less underwool than in the Dharmapuri specimen of August 25; closely resembling the Dendanikota specimen but less buffy; the pattern well emphasised. Two ♀s from Kondagorlapenta, 1,500 ft., July 25 and 27. One has a much thicker and better coat than the Balopalli specimen, with the pattern indefinite; the ground colour is ochreous buff as in the ♂ from Aiyur in the Denkanikota Range. The other example is clearer grey, with the pattern better defined because there is much less black hair on the back.

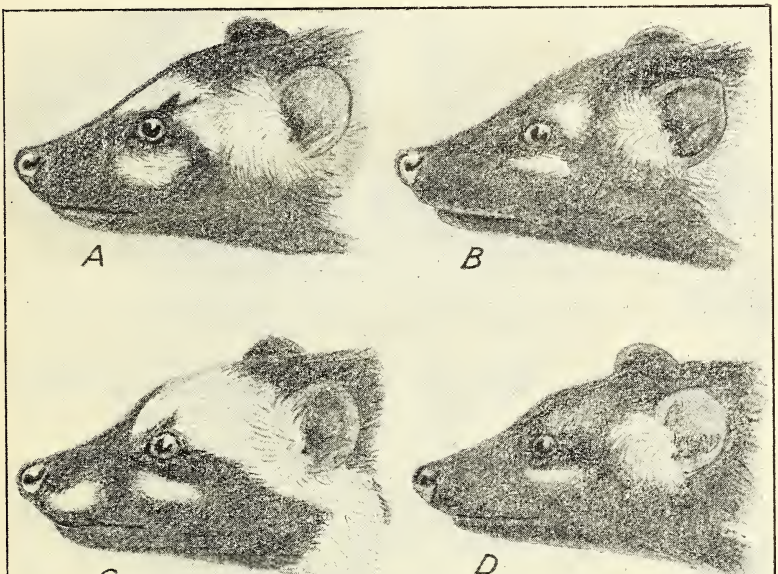

Fig. 1.—*A*. Head of the Common Indian Palm Civet (*P. hermaphroditus hermaphroditus*) from Satara. *B*. The same from the Palkonda Hills showing individual difference of pattern. *C*. The same of the Burmese Palm Civet (*P. h. ravus*) from Mingun showing the broad frontal band characteristic of the race. *D*. Head of the Lesser Palm Civet (*P. h. minor*), from Victoria Point, Tenasserim.

Specimens from Western Ghats: Makut in S. Coorg. An adult ♀ (*G. C. Shortridge*), January 11, closely resembles the example from Madras. The moult is in full force, most of the long hairs being absent from the rump and hind back, exposing the buffy grey under hair, and showing pronounced pattern. Judging from the teats this animal was suckling young.

Haleri, N. Coorg (*J. G. Graham*). A young ♂, December 20 and a young ♀ January 24, are alike in having good coats and the pale interspaces on the dorsal side largely obliterated by the black tips to the hairs, thus obscuring the stripes; but differing in colour, the under hair of the ♀ being pale buffy grey and of the ♂ rich ochreous buff on the back, paler on the sides.

Murdeshwar, N. Kanara. Sea-level (*A. G. Edie*). An adult suckling ♀, and a young one, February 9 and 10, in good coat, are both darkish specimens, the dorsal surface being striped with black and dark grey.

Dharwar (*G. C. Shortridge*). Several specimens, mostly young. One subadult ♀, suckling, December 8, is in full moult; on the rump and hind back the wool is very thin and many of the long hairs are gone; the general colour is darkish grey with black stripes. A younger, but also suckling ♀ from Alnavar, November 3, is like the ♀ from N. Coorg, the pale grey interspaces of the dorsal area being largely obliterated by the black tips of the hairs, but on the sides the ground colour is more exposed and the pattern more conspicuous. Six half grown specimens from Dharwar and one from Boothapaundy in Travancore (*Pillay*) have long coats and the dorsal area streaked with alternate black and grey or buffy grey bands.

Khed in Ratnagiri (*S. H. Prater*). Two young specimens in good coat are dominantly black but still exhibit a dorsal pattern of definite stripes.

Helwak in Satara (*S. H. Prater*). A subadult ♂ and an adult ♀, December 7 and 13, are in perfect coat and almost all black, with abundance of long hairs on the back almost concealing the pale under hair which shows merely as buffy grey patches in the ♂, clearer grey in the ♀. These are the blackest examples of this Palm Civet that I have seen and are the extremes of the '*fuliginosus*' variety named by Gray. The examples from Ratnagiri come nearest to them, but these are only a little blacker than the specimen from Ceylon (Colombo Museum).

Specimens from Central India. Three examples from Hoshangabad (*Crump*) referred by Wroughton to *Paradoxurus* '*crossi*'. Two adult males from Rarighat, 2,500 ft., March 5, and Pachmarhi 3,300 ft., March 21, are in full coat, fuller on the average than in specimens from further south. In both the ground colour is grey, whiter in the one from Pachmarhi than in the other, but heavily overlaid with black, obscuring the pattern, almost as in the examples from Satara. The third from Sohagpur, 1,000 ft., April 1, is very like the others except that the coat is thinning in places and has lost a good deal of its long hair.

In the fulness of the coat as compared with most of the southern Indian forms but not those from Satara, these Hoshangabad specimens, as might be expected, approach the examples from Gwalior described below.

The following are the flesh measurements and weights and the coat lengths of specimens assigned to this race, arranged geographically from north to south.

Locality, Date and Sex.	Head and Body.	Tail.	Hind Foot.	Weight.	Wool.	Hair.
	In English Inches.				In Millimetres.	
Central and South India.						
Pachmarhi, Hoshangabad; Mar. 21; ad. ♂	21½	20⅕	3¼ +	6¾ lbs.	36	49
Sohagpur, Hoshangabad; Apr. 1; yg. ad. ♂	21⅛	21⅗	3¼	7¾ ,,	28	52
Rorighat, Hoshangabad; Mar. 5; ad. ♂	21⅕	20⅗	3⅖	6½ ,,	30	47
Helwak, Satara; Dec. 13; yg. ad. ♂	22½	24⅕	3	10 ,,	30	60
Haleri, N. Coorg; Dec. 20; yg. ♂	21⅕	19⅗	3⅓	...	30	50
Palkonda Hills, E. Ghats; Aug. 11; ? ad. ♂	22⅘	21⅕	3⅖	6 lbs.	32	52
Denkanikota Range, E. Ghats; October 18; ad. ♂	20	18⅘	3⅓	6 ,,	27	49
Dharmapuri Range, E. Ghats; Sept. 13; ad. ♂	21⅗	21⅕	3⅕	7 ,,	28	46
Helwak, Satara; Dec. 7; ad. ♀	21⅖	19⅕	2⅗	8 ,,	27	59
Dharwar; Dec. 8; yg. ad. ♀	22⅘	23	3⅖	...	...	...
Dharwar, Alnavar; Nov. 3; younger ♀	19⅖	19⅗	3 +	...	33	47
Murdeshwar, N. Kanara; Feb. 9; ad. ♀	21	18	3	...	30	50
Makut, S. Coorg; Jan. 11; oldish ♀	22	18⅖	3⅓	...	...	...
Palkonda Hills, E. Ghats, July 27; ad. ♀	21	20⅗	3⅖	6½ lbs.	28	44

	In English Inches.				In Millimetres.	
Locality, Date and Sex.	Head and Body.	Tail.	Hind Foot.	Weight.	Wool.	Hair.
Central and South India—(cont.)						
Palkonda Hills, E. Ghats; July 25; ad. ♀	$20\frac{4}{5}$	18	$3\frac{1}{3}$	6 lbs.	25	44
Dharmapuri Range, E. Ghats; August 25; ? ad. ♀	$21\frac{1}{5}$	$20\frac{1}{5}$	$3\frac{1}{4}$ +	5 ,,	27	46
Ceylon.						
Tammanewa, N.C.P.; May 2; ? ad. ♂	$21\frac{3}{4}$	$18\frac{1}{5}$	$3\frac{2}{5}$	8 ,,	30	48
Udugama, S. P.; April 30; yg. ad. ♀	$21\frac{2}{5}$	19	$3\frac{1}{3}$	...	25	45
Udugama, S. P.; April 30; yg. ad. ♀	$23\frac{4}{5}$	$17\frac{4}{5}$	$3\frac{1}{2}$ +	...	25	38

This table shows approximate equality between adults of the two sexes in the measurements of the head and body and tail, as well as in weight. In fact the young adult ♀ from Dharwar is longer in the head and body than all the ♂ examples, except one from the Palkonda Hills, which it equals; and the young adult ♀ from Udugama in Southern Ceylon is the longest of the series from that island. It may be noticed, however, that the tail in this specimen is exceptionally short and it is possible there is some error in the two dimensions. There are one or two other points of interest. Examples from Ceylon are not smaller than those from S. India, judging from the available data. Nor are those from Hoshangabad, in the valley of the Narbada, larger than those to the south, although they were assigned by Wroughton to *crossi* which he said was larger than the southern specimens he identified as *niger*. The two examples collected by Prater at Satara also call for notice, not only on account of the exceptional weight of the male and the exceptionally long hair of both, but on account of the apparent shortness of the hind foot. The foot of the male, which the skull shows to be almost adult, is actually shorter than in any adult or young found elsewhere, except the adult female, a smaller animal, from Murdeshwar; and the latter has the foot nearly half an inch longer than in the adult female from Helwak. Possibly the 'personal equation' of the collector has to be reckoned with in this case.

In the following table[1] of skull measurements Indian specimens are separated from Ceylonese. Under these two headings the skulls are divided according to sex, the arrangement being roughly geographical from north to south.

Locality and Sex.	In English Inches.					In Millimetres.		
	Total length.	Zygom-width.	Waist width.	Int. orb. width.	Max. width	Bulla.	Pm^4.	M^1.
Central and South India :—								
Pachmarhi, Hoshangabad ; ad. ♂	4·5	2·6½	·5	·7½	·8	18	8 × 6	6 × 7
Sohagpur, Hoshangabad ; yg. ad. ♂	4·4	2·4	·4½	·7	·7+	18	8 × 5	5 × 7
Rorighat, Hoshangabad ; ad. ♂	4·2	2·5	·4	·8	·7	16	8 × 5	5 × 7
Bellary old ♂	4·6	2·7½	·5	·8½	·8+	16	8 × 7	6 × 8
Palkonda Hills, Cuddapah ; ad. ♂	4·4	2·3½	·5–	·7	·8–	18	8 × 5½	5½ × 7
Helwak, Satara ; just ad. ♂	4·6	2·5	·5	·8	·7½	19	9 × 7	6 × 8
Haleri, N. Coorg ; yg. ♂	4·0	2·1½	·5½	·7	·7+	15	9 × 7	6 × 8
Madras ; yg. ad. ♂	(4·2½)	2·3	·5	·7	·8	...	8 × 6	4½ × 8
Palkonda Hills, Cuddapah ; ad. ♀	4·3	2·1	·4½	·8	·7	15	8 × 5	5 × 7
Do. ad. ♀	4·1+	2·1	·4	·7	·7	15	8 × 5	5 × 7
Helwak Satara : ad ♀	4·3	2·2	·5	·7½	·7½	16	8 × 6	6 × 8
Dharwar ; yg. ad. ♀	4·3	2·2½	·5	·7	·7	17	8 × 6	5½ × 7
Dharwar, Alnarar ; yg. ♀	3·8	1·9½	·5	·6	·6+	14	7 × 6	6 × 7

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[1] In this and other tables in this paper skulls are entered as 'adult' when the basioccipital suture is closed. When it is still visible in skulls otherwise showing signs of approximate maturity they are called 'young adults' (yg. ad.). Young skulls are those manifestly undeveloped but with the milk teeth replaced by the permanent set. Immature (immat.) skulls are those retaining the milk dentition. Bracketed figures are estimated total lengths when the occipital region is broken.

Locality and Sex.	In English Inches.					In Millimetres.		
	Total length.	Zygom. width.	Waist width.	Int. orb. width.	Max. width.	Bulla.	Pm^4.	M^1.
Central and South India : —(contd.)								
Murdeshwar, N. Kanara ; ad. ♀	4·1	2·2	·5½	·8	·7½	15	8 × 5½	6 × 8
Haleri, N. Coorg ; yg. ♀	4·0	2·0	·5¼	·7¾	·7	18	8 × 6	6 × 8
Makut, S. Coorg , oldish ♀	4·1	2·2	·4	·8	·8	15	8 × 6½	6½ × 8
Ceylon :—								
Tammanewa, N.C. P. ; ? ad. ♂	4·1	2·5	...	...	·8	17	8 × 6½	6 × 8
'Ceylon' ? Colombo ; yg. ad. ♂	(4·2½)	2·4	·5	·7	·7	...	8 × 6	5 × 8
Udugama, S. P. yg. ad. ♂	4·1	2·3	·5	·7	·7½	16	8 × 6	5½ × 8
Katijagalla, ad. ? ♂	4·2	2·4—	·5½	·7	·7½	17	9 × 7	6 × 8
Do. just ad. ♀	4·0	2·2	·5—	·7—	·7	16	7½ × 6½	6½ × 7½
Kandy ; yg. ♀	3·9	2·0	·6	...	·6½	16	8 × 6	5 × 7½
Udugama, S. P. yg. ad. ♀	3·8	1·9	·6	·6	·6½	14	8 × 7	6 × 8

This table[1] bears out the conclusion, derived from the skin measurements, that the examples from Hoshangabad are not larger than those from further south. The individual variation between the skulls from Pachmarhi and Rorighat, both about the same age, fully developed and closely resembling the old male skull from Bellary, which has no skin, is considerable. The table also shows that ♂ skulls are on the average bigger than ♀ skulls, despite the equality in bodily measurements between the two sexes. It suggests, moreover, that the skulls of Ceylonese specimens are smaller than those from India; but more and better material than I have seen is required to confirm or refute that conclusion. Most of those from Ceylon are not full sized. The male skull from Tammanewa is too broken for its age to be determined. It is certainly, if not quite, adult but would not have exceeded in length the smallest Indian adult male skull, the one from Rorighat. The larger of the two skulls from Kotiyagalla, both presented without skins by Mr. Phillips, is unfortunately not sexed, but the one marked ♀ is a trifle smaller than the smallest Indian adult female skull. Nevertheless the female skull from Kandy, which is changing its teeth, is bigger than the one from Alnavar in Dharwar, in which the tooth change is completed.

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[1] In this and other tables in this paper skulls are entered as 'adult' when the basioccipital suture is closed. When it is still visible in skulls otherwise showing signs of approximate maturity they are called 'young adults' (yg. ad.). Young skulls are those manifestly undeveloped but with the milk teeth replaced by the permanent set. Immature (immat.) skulls are those retaining the milk dentition. Bracketed figures are estimated total lengths when the occipital region is broken.

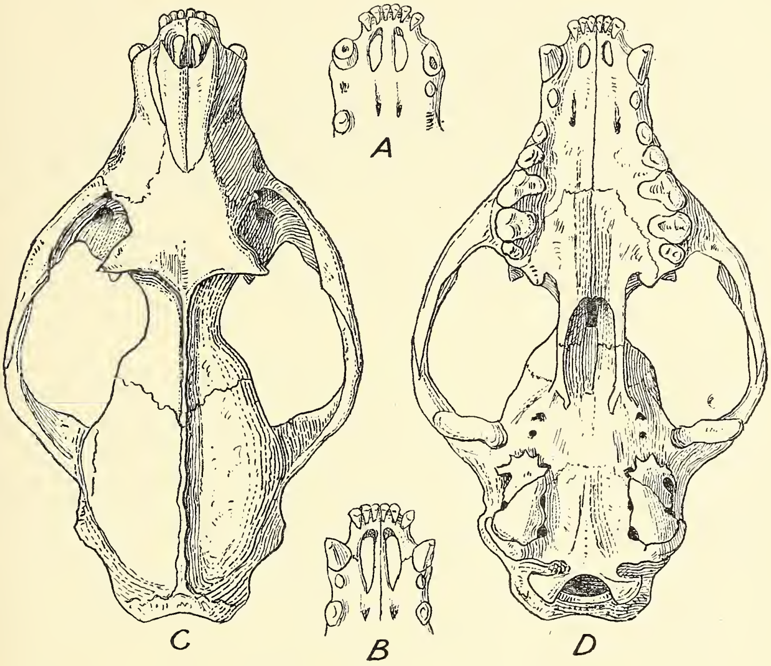


Fig. 2.—*A*. Anterior part of palate of a very old specimen of *P. jerdoni* showing the shortening of the foramina with age. *B*. The same of younger specimen from Tiger Shola, Palni Hills. *C*. & *D*. Upper and lower views of exceptionally well developed male skull of *P. h. hermaphroditus* from Bellary. All 2/3 nat. size.

The bullae in adult Indian skulls vary considerably in length, as illustrated by the male specimens from Bellary and Satara and the females from Coorg. The teeth also vary. Both the upper carnassial (pm^4) and the first molar (m^1) are a millimetre larger each way in the male skulls from Satara and North Coorg than in the skull from Rorighat, Hoshangabad, and the difference is very noticeable visually. The measurements of the young female skull from Alnavar in Dharwar have been entered mainly for comparison with the adult female skull from Hazaribagh described below under *nictitans*.

The sagittal crest is well developed in adult ♂ skulls. It is about 4 mm. high in the skull from Pachmarhi, Hoshangabad, and reaches 6 mm. in the old skull from Bellary. The postorbital processes on the frontal bone become broad at the base with age and set more transversely, their posterior edges being approximately in a straight line. In adult and old ♀ skulls the crest is complete but only about 1 mm. high, as in the skulls from Satara, S. Coorg and the Palkonda Hills; but the crest is late in forming. In the skull of a young adult ♀ from Dharwar the ridges are 5 mm. apart on the frontals and 10 mm. on the parietals. In the younger ♀ skull from Haleri, N. Coorg, which has the last molar just up, there is scarcely even a trace of the temporal ridges.

(To be continued).

A VISIT TO WHIPSNADE ZOOLOGICAL PARK.

BY

Lt.-Col. R. W. Burton, *I.A.* (Retd.).

Of those who visit Whipsnade but few have been to other parks of the kind in foreign countries, yet the impression of one and all is that here is the best, as it is the largest, of its kind in the World!

The Zoological Gardens in Regent's Park were instituted more than a century ago (1829) by the Zoological Society of London, and it is nearly sixty years since the writer first witnessed the 4 o'clock feeding of the lions, and other sights so entrancing to a small boy.

Since those days many improvements to the London Zoo have been carried out and visitors at the present time see a number of animals and birds in a less restricted state of captivity; yet, great as the additions and improvements to the Zoo have been, the acquisition by the Society of Whipsnade Park has given comparative freedom to many animals and birds amid beautiful surroundings and a greatly ameliorated restraint to several species of carnivora.

The area of the Park is about 500 acres, at an elevation of 600 to 700 feet, on the edge of the Dunstable Downs which are a part of the Chiltern Hills in the County of Bedfordshire. The elevated site so wisely chosen for this Park for the breeding and exhibition of wild animals, and as a sanctuary for British Wild Birds and British Wild Plants, affords views of much natural beauty within the boundaries of the estate itself, and wide prospects of the surrounding country from various view points.

On the upper slopes, to the west especially, where the visitor can rest at ease with an unrestricted view of valley and rolling hills spread out before him, will great enjoyment be attained. Here, on the edge of the downs, and above the great White Lion which has been so skilfully formed by means of chalk as an abiding landmark to attract the eye from many miles, the peace and quiet of this English landscape can answer to the influence of the hour notwithstanding that within a minute's walk are lions and tigers, bears and bison, and that now and again there is borne to the ears the wild sonorous call of the Sarus Crane—that stately-pacing bird so well known to the inhabitants of India—the roar of a chital stag, and perchance other sounds of a wild life strange to the countryside.

Since the Park was opened in May 1931 much has been done, yet less than half the area has been developed. All is proceeding on a preconceived, ordered plan; and what has been accomplished in so short a period is good augury for the perfection which the future years will bring.

There are many approaches to Whipsnade by rail and road from all parts of the country and the distance is but an hour (35 miles) by car and little more by bus from King's Cross station. For the many who will wish to visit the Park for more than the hours available in one day there is hotel accommodation at Luton, Tring, Dunstable, and other neighbouring towns.

Entering by the Whipsnade Gate at the junction of Central Avenue and Duke's Road the Bird Sanctuary is close by on the left, and a short distance up the Avenue is the enclosure containing the Demoiselle Cranes. These lovely silvery-grey birds with graceful black chest plumes are well known to the peoples of the greater part of India as cold weather visitants from their far-distant breeding grounds beyond the Himalaya Mountains; with them are some jungle fowl, the progenitors of all the domestic fowl of the world, and other interesting birds; while on the paths and lawns in the vicinity peafowl display their gorgeous plumage.

Close at hand, in the Central Paddock, is a herd of Highland cattle and adjoining it is Wallaby Wood where one can feed and stroke sundry extremely tame animals of this docile species. Here also are Tree Kangaroos.

Further up the main avenue the half dozen Dingo dogs of Australia claim attention of all visitors by their playful friskings and gambolings. It is a delight to watch them romp about in happy contention for possession of a chance-won piece of cloth, and at feeding time it can be seen how very tame these animals have become; more tame indeed than one of their kind which the writer acquired as a pet from the Durban Zoo in 1918. Snappy she was, and not entirely safe to handle.

Beyond the Dingo's are the Home and Chartley Paddocks which contain Fallow and Red deer and a herd of splendid cream-coloured Chartley Cattle (Chartley Park, Staffordshire). The proud owner of the finest horns among the Red deer is friendly to visitors so has a much-stroked nose.

In and around a pond near the Hill Farm Restaurant are several varieties of water birds—geese, ducks, moorhens—all very tame, also flamingos and other waders. The inhabitants of the Beaver Ponds do not seem to appear during visiting hours, but perhaps these most interesting animals will in course of time be less retiring in their habits.

At the end of the Central Avenue the road bears round to the right (west) as the large open fields which are straight ahead have not yet been developed. The public has access however, and as the shadows lengthen and the animals, as is their habit, come into the open to feed, one can wander slowly along the hedgerows to be rewarded with the fascinating sight of herds of Chinese Water deer, the white variety of Red deer, the Swamp deer of India, and the Muntjac or Barking deer of tropical countries. All these are free to wander where they will within the precincts of the park and have all of them produced fawns since their arrival at Whipsnade. So quickly indeed are these animals increasing—

the Chinese Water deer have more than trebled their numbers—that the showy black and white Spanish Sheep introduced to help to keep the grass in order will soon be no longer required; and the Park will be self-supporting as to meat for the carnivora. Besides the deer, many of the birds common to the fields and hedges will be observed, and a number of rabbits which have as yet not realized that in this place they have no enemy in man.

Here it may be mentioned that for the full enjoyment of all the park has to offer the use of field glasses is necessary; for many of the enclosures are so spacious that without them it is often not possible to observe some of the animals and birds.

Following along the main path five large paddocks are found on either hand. In the Round Close are Nilgai—the male of which is the Blue Bull of India, one of the largest of the antelopes; and Sarus Cranes, stately grey-plumaged birds with red heads which pair for life and are unmolested by any of the peoples of the plains of Hindustan.

Among animals in the other paddocks will be seen Camels of three species; Llamas and Alpacas from South America; Mongolian Wild Horses; the Yak, the wild ox of Tibet, the hybrid of which is known as the Zho; and the Wild Ass of the same country, commonly called the Kiang, whose inquisitiveness has spoilt the careful stalk of many a sportsman in pursuit of the wild sheep of Ladak.

In a somewhat secluded paddock at the back of Bluebell Wood are two male Lechwe of South Central Africa, handsome Waterbuck of light tawny colour with long sublyrate horns. Like many wild species they have a white hoof band, and by their evident timidity and some want of condition it can be seen that they are enjoying recently granted liberty. Now, after all their terrifying experiences since they were first sighted by those desiring their capture in their native swamps, they have before them a happy care-free life, and will soon learn that the roars of the lions and the tigers have no menace for them.

In the wide expanse of Spicer's Field are Zebra and a male Ostrich, a Pigmy Hippopotamus from West Africa, a Marabou Stork, and cranes of three varieties including the conspicuous Crowned Crane of West Africa. The Ostrich does not approve of the zebras as they appear to enjoy pulling out his tail feathers with playful nips. All that was visible of the hippo was his rotund recumbent form in the centre of the field. At the back of this large paddock is a small field in which are six young ostriches appreciative, in common with many of the birds and animals affording pleasure in this way to visitors old and young, of ground nuts.

Below Escarpment Avenue on the slope of the Downs are the tiger, lion, and polar bear enclosures; also other excavations from the chalk—some being of very ancient date—which have been adapted for the accommodation of various animals. The lions seem to the casual eye to be better off under present arrangements, which are said to be experimental; but considering all weathers it is probable that the tigers have the advantage. Yet there is much room for improvement as to their accommodation which will no doubt be carried out when funds permit.

One of the polar bears is a real clown, and affords endless amusement to himself and his laughing visitors by his somersaults over a floating fir-log, and his toyings with an empty tin which he dives for and throws into the air in never-ceasing play.

The inhabitants of the Woodchuck, Marmot, Wombat, and Porcupine enclosures are not always visible and it is well to ascertain their feeding time. The porcupines emerged to a patient watcher, and it was interesting to observe the hostile attitude of one which rattled the quills of its hinder parts towards another, and the rabbit-like warning stamp of the hinder foot of the possessor of the ground nuts which had been thrown as a camera bait.

On the northern slopes, the American Bison herd lives with a number of Moufflon, while the field below contains Barbary sheep and the semi-wild sheep of the Island of Soay, St. Kilda, Hebrides. As regards the bison it may be that the Society has in mind the successful Canadian experiment of crossing these fine animals with domestic cattle and so providing for the home producer the valuable Cattalo, as the hybrid is termed. In the vicinity of the bison enclosure coveys of quite tame partridges can be seen about the Old Flint Pit.

Space is running short and there is so much to describe!

Turning in the direction of the main entrance, a path takes one close to the Ouseley Pond on the reedy edges of which several saurians of Africa or America can be seen, also sundry water birds, flamingos and the like. It is a very realistic pool giving one the impression that it might contain anything unpleasant from a tropical country. Then we see a herd of chital in a piece of thorn jungle which looks as if it has been transplanted from the natural habitat of these lovely spotted deer, the Axis Deer of India. Two of the stags are in combat and after a lengthy battle he of the larger antlers prevails, gets his adversary on the run, and speeding him with prods behind announces his victory by a wild challenging roar which brings to memory many a jungle scene. The keepers have a wholesome respect for the pugnacity of these stags during the rutting season.

The roomy bears enclosure contains two shaggy Sloth Bear of the plains of India; a fine specimen of the Himalayan Black Bear: and two brown European bears. All of these afford no end of amusement to visitors, the larger of the brown bears being equal in clownish antics to the polar bear we have just seen. It is interesting to notice how the three species keep themselves to themselves and pass impolite remarks to one another when they meet, as they must do now and again. When first turned into this enclosure they had trees into which to climb and make platform nests but have stripped off all the branches, and the big brown fellow was seen exerting all his strength in a successful effort to detach the only remaining projection from the main trunk.

A movie picture of these animals would afford many amusing incidents. At time of writing the Himalayan Bear is ten years old. I saw him as a baby soon after he had been captured by Mr. R. H. Paddison near the hill station of Ranikhet, in the United

Provinces of India. He is a first class beggar and has attained aldermanic proportions. Please give him a tin of condensed milk!

Lastly we arrive at the fir wood in which are the wolves in almost natural surroundings, for one can easily imagine snow on the ground, and the gloom of the forest is before the eyes. They snatch up pieces of raw meat thrown by the keeper at feeding time but will eventually become tamer, as can be seen, for one of them will almost take meat from the hand. The Timber Wolf is large but the others seem smaller, in comparison, than the wolves of India. The wolves and the dingoes have both bred so well that there are some young animals for disposal to suitable purchasers.

Next to the wolves is a Tibetan mastiff, a fine dog similar to many one has met on hill paths in the Himalayas and so I told him he ought to be given human companionship and not shut up next to his wild progenitors.

In Wallaby Wood is a large oak tree—to be known as Tarzan Tree—which is the centre piece of an enclosure for some two score Rhesus monkeys. These will be a great attraction to visitors: as also will be the Chimpanzees when on summer holiday from the London Zoo. The grey squirrels found when the Park was acquired have been destroyed, and the red squirrels introduced are increasing. The air of Whipsnade seems to be very invigorating; for not only have there been all the increases noted but the tigers have young ones. also the beavers; and such birds as the Sarus Crane and the Rhea have hatched their eggs.

And now we have seen most of what the Park has to show, yet something remains. There are the Shetland and New Forest ponies, the Anoa or Dwarf Buffalo of the Island of Celebes, the minute Pudu deer from the Chilian Andes, and the elephant on which you may ride for six pence; and an hour of quiet observation in the bird sanctuary where are the beautiful Ahmerst pheasants of Eastern Tibet and China, and other gorgeous pheasants of Burma and India, the Brush Turkey of Australia, and other show birds.

Your field glasses will be wanted to watch all these and those species (67 have been observed in the park) of our indigenous birds which have their home in this quiet wood. Here also barking deer creep about in the undergrowth exactly as they do in their native jungles, and perhaps you may be fortunate and see a tiny fawn.

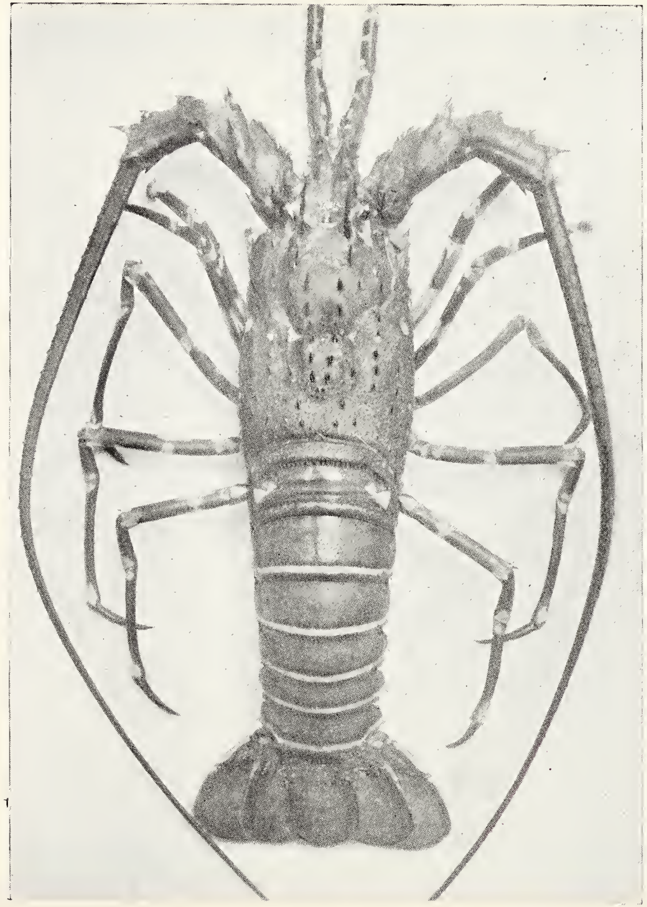
Enough! The reader can well realize that even three days can be fully occupied if all that is seen is to remain in the memory. Nature demands quiet contemplative observation and cannot be rushed; so it is during the evening hours that Whipsnade should receive most attention from the visitor who is desirous of carrying away those charming memories which are due to all that this beautiful park has to offer. And in any case there will surely be a feeling of real gratitude to the Royal Patron, and the Council of the Society the work of whose Secretary is for ever commemorated by the thousand yard avenue to be opened up from the future southern entrance at Dagnall Gate and so fitly named 'Sir Peter's Way'.

An Afterthought.

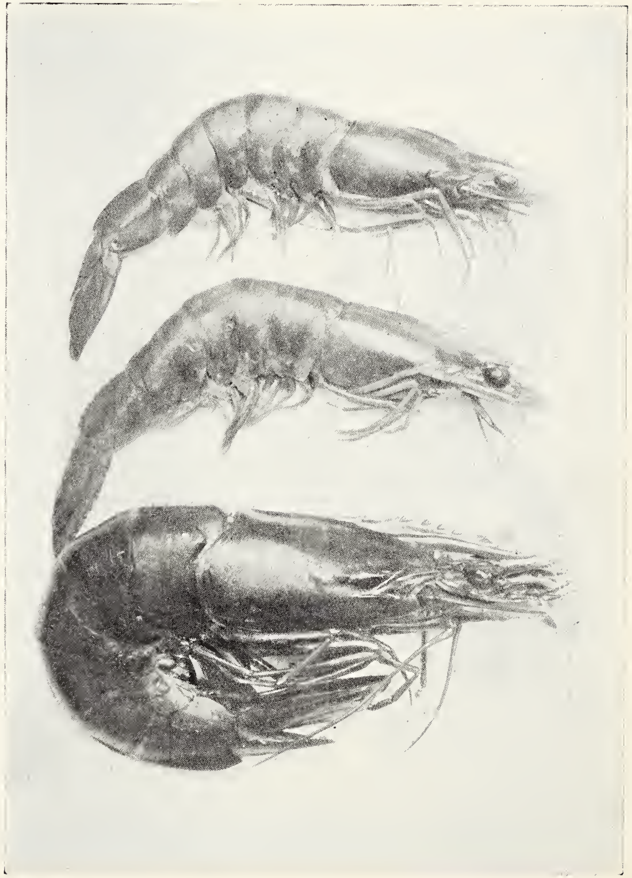
The question of the Safeguarding of Wild Life in India (as indeed throughout the World) is now much to the fore.

In his learned book of Essays—'S. V. A.'—Sir George Birdwood suggested many years ago that the Field of all the Panipat's—those historic battles for the supremacy of power in Hindustan—be dedicated by the Government of India to the perpetual service of the public as an inviolable sylvan sanctuary on the scale, and after the manner, of the Yellowstone National Park (and others of its kind now established in many countries) as an Indian National Park worthy of the Imperial Delhi of the Past and of the Future.

Hindu-Moslem Unity! Here is an idea which seems worthy of attention by the Government and the Leaders of the two Communities.



Panulirus ornatus var. *decoratus* Heller.



Peneus indicus (E. Edw.).

THE SHELL-FISHERIES OF THE BOMBAY PRESIDENCY.

Report of the Bombay Natural History Society's Survey.

BY

HARDIT SINGH RAI, M.SC.

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PART II.

(*With 2 plates, 2 blocks and 3 text-figures*).

(*Continued from page 847 of volume* xxxv).

The present paper deals with the shell-fish belonging to the group known as *Crustacea*, which includes a large and varied number of animal forms. The majority of Crustaceans are marine. The most important and well-known are the Prawns, Lobsters and Crabs, constituting the higher members of the group. They usually possess 20 segments and 19 pairs of appendages. Being generally aquatic, they are good swimmers, but many are adapted to walking. The head and thorax, fused to form what is known as the *cephalothorax*, is encased in a calcareous shell—the *carapace*. The abdomen is visibly segmented, each segment being dorsally protected by a calcareous surface, like that of the cephalothorax. The appendages, the feelers, legs, swimmerets, etc., are modified

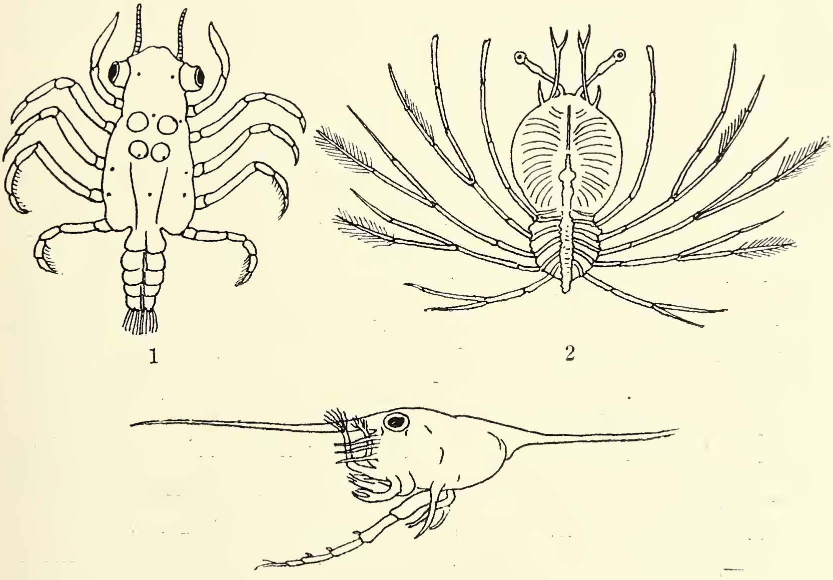


Fig. 1. *Megalopa* larva of Crab. 2. *Phyllosoma* larva of Lobster. 3. *Loea* stage of Crab.

to suit the various functions to which they are adapted. Respiration is carried on by the *branchia* or gills which are enclosed in the carapace. The sexes are separate. Fertilization is external. The eggs are usually carried in a mass under the abdomen of the females by the aid of a portion of the swimmerets. Prawns in egg are sometimes referred to as 'Berried' Prawns. Between the egg stage and the adult there is frequently a striking, varied and interesting metamorphosis.

In typical cases the newly-hatched larva is called a *zoaea*. In the zoaea stage the thorax is well developed while the abdomen, particularly the hindmost portion of it, is rudimentary. After the zoaea stage, the larva passes through yet another, the *mysis*, in which it more closely resembles the adult. A series of successive moults are gone through before reaching maturity—the entire exoskeleton being cast at each moult.

Prawns.

Prawns are in great demand by many sections of the population. Containing a high percentage of protein and soluble fat, they form a nutritive and valuable food.

The shells are used as manure or fertilizers. Recent investigations have indicated that the 'bran', or powdered shells, is very nutritive and consequently valuable food for farm animals, such as pigs, poultry, etc. Hundreds of tons are annually exported from Karachi to foreign countries. At Karachi, the price varies from Rs. 3 to 4 per maund.

Species of economic value. There are about a dozen species found along the Bombay coast. The most important and abundant species are, *Peneus semisulcatus* (de Man), *Leander styliferus* (M. Edw.) and *Metapeneus monoceros* (Fabr.). *Peneus* is the commonest genus and is the typical representative of the order *Penacidea*. *Peneus semisulcatus* varies in size from 7 to 8 inches, but giants of 10 to 12 inches are obtained. *Leander styliferus* may be distinguished from *P. semisulcatus* by its smaller size, a phyllobranchia and a chela on each of the first two pairs of legs. Besides the marine, there is the freshwater prawn, *Palæmon*, found in the sluggish rivers and tanks. In some localities, such as Surat, this prawn attains a very large size, at times a foot in length and a pound in weight.

The following table will indicate the other species met with:—

No.	Species.	General Remarks.
1	*Metapeneus monoceros* (Faber).	Found in very large numbers along the coast and grow to 4 inches.
2	*Metapeneus lysianassa* (de Man).	Large, 6–7 inches in length.
3	*Metapeneus brevicornis* (M. Edw.).	4–5 inches in length ; transparent body.

No.	Species.	General Remarks
4	*Parapeneopsis sculptilus* (Heller).	Normal length 4-5 inches ; transparent body with red patches.
5	*Parapeneopsis stylifera* (M. Edw.).	About 3 inches.
6	*Parapeneopsis uncta* (Alcock).	4½ inches long.
7	*Leander potamiscus* (Kemp.).	Small ; about 2 inches. Breeding season Sept. Bombay, in large numbers.
8	*Leander* Sp. ...	About an inch.
9	*Leander styliferus* (M. Edw.).	About 2 inches normal size. Breeding season Sept. Bombay.
10	*Peneus semisulcatus* (de Man).	Large ; about 10 inches, with purple spots and bands. Found in large numbers in Sind.
11	,, *indicus* (E. Edw.).	6-7 inches in length. Body usually scarlet. Very abundant on Sind coast.
12	,, *indicus* Var *merguiensis* (de Man).	Sind and Bombay coast.
13	*Acetes indicus* (M. Edw.).	Small, common, seldom grows more than an inch, found along the Bombay coast.
14	*Palæmon carcinus* (Faber).	About a foot in length and weighs about a pound. Collected at Surat.

Breeding season and migration. Apparently prawns are migratory and their movements are associated with the breeding habits. They are most abundant in our coastal waters between August and October, when the majority of egg-laden prawns are taken. We may conclude that this is the breeding season and that these *Crustacea* at this time migrate to shallow water. The Norwegian Prawn, *Pandalas borealis*, has been observed, during the time of its scarcity along the coasts, to migrate to deeper waters. There is an 'inshore and offshore phase' of its migration. The same phenomenon may possibly be exhibited by our Indian species. Their migratory habits may also be attributed to the following causes:—

(1) Physical and chemical conditions of the water; particularly temperature, salinity, rainfall and the nature of the currents etc.

(2) Spawning: the urge for suitable breeding grounds.
(3) Food: the necessity of suitable feeding grounds.

Distribution. Prawns are exceedingly common on the Sind and Bombay coasts. Though obtained in waters along sandy shores they appear to prefer wates with muddy bottoms, where they are most sought for by the fishermen. Prawns creep along the bottom but are also equally adapted for swimming. Backward progression is frequently resorted to. This is effected by rapidly flexing the abdomenal region under the rest of the body.

Value of yields. Millions of pounds of prawns are caught annually. Apart from local consumption, large quantities are despatched inland and also exported to foreign countries. The total consumption along the Bombay coast alone may be estimated at 12,000,000 lbs., valued roughly at Rs. 2,500,000. The prawn industry alone, along this coast gives employment to about 20,000 men, women and children.

Sind Prawn Fisheries. The Sind coast is well known for its valuable fishing grounds and here is found one of the largest prawn fisheries in India. The fishing grounds extend from Karachi on the west, to Patiani creek on the east, an extent of about 100 miles. The coastal areas in Sind are composed of low lying mud flats of deltaic origin. Large portions of these flats are covered with mangroves and are submerged at high tide. They stretch for miles and are intersected by numerous channels connecting many small creeks. The creeks communicate with the sea. With the exception of the rise and fall of the tides, these waterways are but little affected by the sea. The water in them is muddy and contains an abundance of algae. The principal creeks in which prawn fishing is extensively carried on are:—Gizri, Kharanja, Piti, Khaderi, Khai, Pitiani and Dubha.

Most fishermen restrict their operations to the creeks, at comparatively short distances from the shore, some, however, go out to sea. The season is at its height from November to January when enormous numbers of prawns enter the creeks. They apparently form ideal spawning and feeding grounds. Numerous fishing camps are established on suitable sites. In selecting a fishing camp it is all important that the site should be on dry, preferably sandy, beaches. Pitiani is one of the largest fishing camps. Hundreds of fishermen and their families move out to it during the fishing season and return to their homes by the end of March. Drinking water is the chief difficulty in these areas. It is brought in bulk from either Bram-hydri, Rohri and other distant places, or is brought by the boats which call daily at the fishing camps and return to their home ports laden with fresh and dry fish for market.

Value of produce. It is estimated that the total catch in Sind is over 6,000,000 lbs. valued approximately at Rs. 1,500,000.

Statements showing the export of dry prawns and their shells from Karachi to other ports, Indian and foreign, during the years

1927-28, 1928-29, and 1929-30 are as follows: (from the Records of the Customs Department, Government of Bombay):—

Countries whither exported.	Year.		Year.		Year.	
	1927–28.		1928-29.		1929–30.	
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
Fresh Prawns	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
Dry Prawns						
Hong Kong	960	54,470	819	47,860	1,617	92,465
Mauritius and Dependencies	361	18,730	264	10,460	425	18,689
Ceylon	65	1,950	...	...	...	...
Straits Settlements ...	873	49,175	363	18,745	231	12,970
Other British Possessions...	...	15	1	70	4	180
Other Native States in Arabia	155	7,800	65	4,470	62	3,140
Other Foreign Countries ...	...	...	1	45	...	...
Calcutta	2	100	...	...	...	...
Bombay	166	5,500	430	20,858	395	21,290
Rangoon	10,298	6,52,287	8,230	5,02,490	16,293	8,78,347
Kathiawar	...	...	6	130	...	...
Total ...	12,880	7,89,027	10,179	6,05,128	19,027	10,27,081
Prawn Shells						
United Kingdom Cwts. ...	...	...	230	1,716	...	...
Ceylon ,, ...	1,219	6,466	...	...	273	1,875
Germany ,, ...	12,607	43,407	6,176	37,194	13,777	1,11,326
Belgium ,, ...	370	3,250	130	1,260	...	...
Netherlands ,, ...	1,970	16,700	6,890	49,189	2,667	19,515
Rangoon ,, ..	...	...	7	30	...	...
Total ...	16,166	69,823	13,433	89,389	16,717	1,32,716

Bombay Prawn Fisheries. Much prawn fishing is done along the Bombay coast. The fishermen confine their activities to waters within 10-12 miles of the home ports. In some of the coastal ports the industry reaches considerable proportions, depending much on the proximity of large towns where the demand is great.

To the north of Bombay, in the Thana and Surat districts, prawn fishing is carried out on a large scale. The chief prawn fishing centres are, Palghar, Maroli, Umbergaon Creek, Nawapur, Kalwe, Arnala, Bassein Bunder and Versowa. To the south, Alibag, Jaigad, Vaorda, Ratnagiri, Purangad, Jaytapur, Vizedrug, Malwan and Vengurla. The further south one goes from Bombay prawn fishing appears to decrease. The scattered prawn industry along the North Kanara coast is on a smaller scale than elsewhere in the Presidency. The most important centres along this coast are, Karwar, Tadri and Honaver.

Craft employed. Along the Bombay coast the usual type of fishing smacks are used. They vary in size and in the number of the crew according to the dimensions of the craft. These fishing smacks range between 20 and 40 feet in length and are capable of carrying a load of ½ to 1 ton.

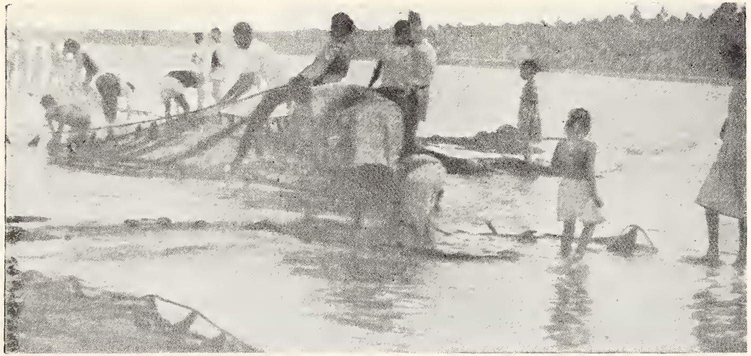
Nets and methods of fishing. Fishing methods differ only in minor details in different places. The nets employed for prawn fishing are much the same along the whole Bombay coast, including Sind. Slight difference may be noticed in their size and quality. The catches vary much with the season and the time of fishing. The largest catches are made near the surface, as prawns usually frequent the surface strata of water at night, when most prawn fishing done. Nets are shot round a shoal when spotted and hauled in. The gleam of the phosphorescent bodies in the dark water reveals the portion of the shoal.

The following types of nets are used:

(1) 'Dip net'—*Yedi.*
(2) 'Cast net' or 'Purse Seine'—*Pag.*
(3) 'Wall Seine'—*Para* or *Jali.*
(4) 'Bag Seine'—*Bokhsi* or *Dol.*

(1) 'Dip net'—*Yedi.* A rectangular sheet of netting 12 feet long by 8 feet wide. A bamboo pole is attached to each of the shorter sides. The mesh is generally very fine and consequently little escapes from it. These nets are used in shallow waters. Two men are required to work it; one stationed at each end. The net is drawn through the water at an oblique angle and after the men have traversed a certain distance in this way, it is lifted out and its contents collected.

(2) 'Cast net'—*Pag* is in universal use along the coast and well suited for both shallow and deep water. A circluar net. The size of the mesh varies according to the type of fishing, but rarely exceeds ¾ of an inch. Its circumference is weighted at short intervals with lead. A long string is attached to the centre of the net. The other end of the string is wound in a loop round the wrist. The net when cast opens out to its full circumference and the weights soon carry it to the bottom. When used in deep water, after it has gone to the full length of the line, the weights converge and close the bottom of the net thus securing its



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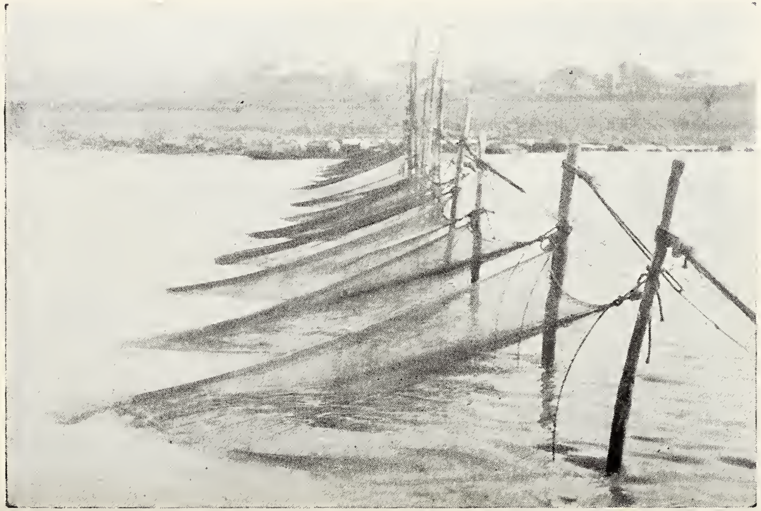

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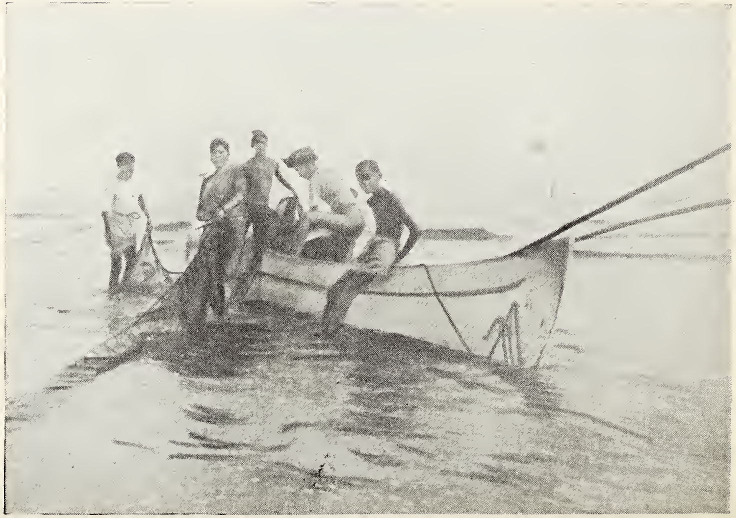

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1. 'Pag' in use in shallow water. 2. 'Bokhsi' in position at Mahin, Bombay. 3. Hauling the 'Para' out. 4. 'Para' being hauled into a boat.

contents. When used in shallow water once the net reaches the bottom it is gradually hauled in, the weights coming together in the process and closing it.

(3) 'Wal Seine'—*Para*. Composed of a length of net which varies from 200-400 feet with a width of 10-15 feet. The upper margin is attached to floats, placed at frequent intervals, to keep it at the surface. The lower margin is weighted. Two stout ropes at the extremities serve in hauling it in. The number of men employed to handle the net varies according to its size. The method of laying the net is as follows:—One end is held by men in shallow water while the rest is paid out from a boat which describes a wide circle till the entire net is set. The two ends are now gradually brought to within a few feet of one another and the net is gently drawn ashore.

(4) The 'Bag Seine'—*Bokshi* and *Dol*. There are two types, differing only in size. The smaller *Bokhsi* is intended for use in shallower waters than the *Dol*.

The *Bokhsi* is conical in shape. Its size varies with the locality. It averages about 30 feet in length with a mouth 8-10 feet in diameter. The narrower extremity is about a foot in diameter. At this end there is a small removable bag-like appendage. The mesh diminishes in size from 1½-1 inch at the mouth to about ½ inch at the narrower end.

The *Dol* is very much larger frequently measuring 5-700 feet with a mouth 2-300 feet in circumference. In both cases the upper margin of the mouth is suspended by means of floats, while the lower is weighted. Both nets are set against the tide which sweeps the catch into them. These nets are emptied with the turn of each tide. Before setting either the *Bokhsi* or the *Dol*, the 'cast net' is used to locate the prawns.

Preparation of catches for Market. Fresh prawns are packed between layers of ice and sent to inland towns. Prawns are either packed whole or the cephalothorax is removed in order to save space and freight. Those intended for local consumption are sent directly to market on arrival of the fishing smacks.

Large quantities of prawns are preserved in the dry state, either by sun drying or by boiling.

Sun drying is by far the commoner method of the two. The fresh prawns are removed to places set apart for drying. Here they are spread out and left to dry in the sun. When they have dried hard they are trampled to remove the shells. The drying is effected in 2-3 days when weather conditions are favourable.

Boiling. Used on the Sind coast. The prawns are placed in kettles containing enough sea water to submerge them—a little salt is generally added. They are boiled for about half an hour, then removed to drying platforms, where they are spread out in a thin layer. In about two days they are perfectly dry. They are now 'threshed' with sticks to remove the shells. After this process they are further cleaned by women, who again beat them with small wooden boards to remove any remaining portions of the shells. When cleaned, the prawns are sorted out according to size and packed ready for despatch.

Quantities. Large quantities of fresh and dried prawns are sent to the Bombay markets from the following localities. No reliable figures are available. The following table gives approximate quantities and values and the results of inquiries made in the Bombay markets and in the moffusil.

Serial No.	Place.	Quantity.	Approximate Value.	General Remarks.
			Rs. A. P.	
1	Bassein ...	20,000 lbs.	2,000 0 0	...
2	Versowa ...	30,000 ,,	3,000 0 0	...
3	Bandra and Mahim ...	30,000 ,,	3,000 0 0	...
4	Trombay ...	15,000 ,,	1,500 0 0	...
5	Thana ...	25,000 ,,	2,500 0 0	...
6	Mora ...	500 cwts.	5,000 0 0	...
7	Sheva ...	300 ,,	1,100 0 0	...
8	Rewas and Dighodu ...	25,000 lbs.	22,000 0 0	Small dried prawns called 'Sodas' are sent to Bombay, Kalyan and other places.
9	Alibag and Revanda ...	70,000 ,,	7,000 0 0	Prawns from here also sent to Ratnagiri and Kalyan and other places.
10	Bankot ...	35,000 ,,	3,500 0 0	...
11	Kelsi and Adha			
12	Anjora Creek			
13	Hornai ...	10,000 ,,	1,000 0 0	Only dried prawns are sent to Bombay from this locality.

Market rates. The following table gives the market rates of fresh prawns together with the vernacular names. The rates differ with the season.

No.	Place.	Local Name.	Bazar rate, Annas.
1.	Bombay Markets ...	Kolambi (Ginga) ...	As. 4–0 to As. 5–0 lb,
2.	Thana	,, ...	,, 3–6 ,, ,, 4–6 ,,
3.	Alibag	,, ..	,, 2–0 ,, ,, 3–0 ,,
4.	Ratnagiri ...	Kolim	,, 1–6 ,, ,, 2–0 ,,
5.	Malwan	Chingul	,, 2–6 ,, ,, 3–6 ,,
6.	Karwar	Sungta	,, 2–0 ,, ,, 3–0 ,,
7.	Karachi	Jhenga	,, 3–0 .. ,, 4–0 ,,

CRABS.

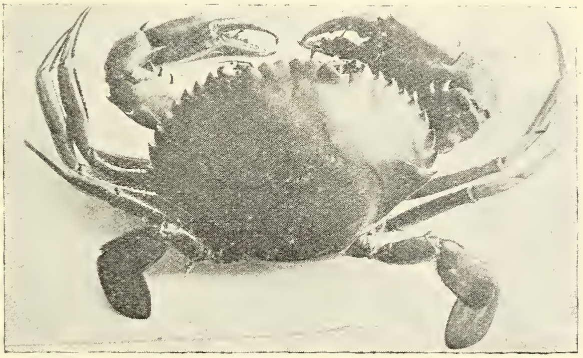
In places along the coast crabs are a well established food. There is a great demand for them in large towns. 'Crab curry' is a reputed cure for asthma.

Crabs belong to the sub-order *Branchyura* of the *Crustacea*, in which the abdomen is greatly reduced and permanently flexed under the cephalothorax. In common with the other members of the *Crustacea* the entire exoskeleton is cast periodically. During the time of moult crabs secret themselves until the fresh carapace has hardened. After every moult there is a decided increase in size. Barnacles are frequently seen on the carapace of crabs. The eggs, also known as 'egg cake' or 'sponge' are carried in a mass under the cephalothorax and held in position by the flexed abdomen and the reduced swimmerets. The young pass through two free swimming stages, the zoea and the *magalopa*.

Breeding season. Crabs appear to breed during the monsoon months. I have taken numerous larvae during the month of October. They are collected by fishermen almost all the year round but the largest catches are made from August to October. During the hot season crab fishing is discontinued as they are not considered to be of any value at that time.

Species. There are three marketable species that are commonly found along the Bombay Coast:—

(1) *Scylla serrata* (Forskal) is the commonest of the Bombay crabs. It is widely distributed and is to be met with in all markets along the coast. Size, 8 inches broad by 6 inches long. Claws large and strong.

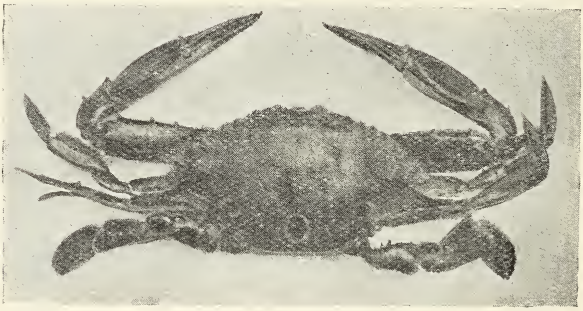


Scylla serrata (Fordkal).

(2) *Neptunus sanguinolentus* (Herbst.) common on the coast south of Bombay. Somewhat smaller than the foregoing species. Colour, red brown, with three scarlet patches on its back. Claws long and slender.

(3) *Paratelphusa* (*Barytelpliasa*) *jacquemontii* Rathbum. Collected in large numbers along the coast and sent to the Bombay markets. Colour, dark; size 5 inches.

Methods of fishing. Crabs are generally trapped in 'dip nets' in which a bait has been tied. In shallow water and in creeks crabs are caught with sieve nets. The nets are so arranged that once the crab gets in it is unable to escape. Another method of collecting crabs is by means of a hooked iron rod, which is used for extracting the crabs from the rock crevices between tides.



Neptunus sanguinolentus Herbst.

Marketing. Crabs are generally marketed alive. To effect this they are kept in earthern urns.

Value of yield. The total number of crabs annually sold in the Bombay markets may be estimated at 80,000 roughly valued at Rs. 10,000. The combined total of the Bombay and Sind catches may be estimated at 5,00,000, approximately valued at Rs. 30,000.

LOBSTERS.

Species. There are two species of Lobster obtained along the Bombay-Sind coast:—

(1) *Panulirus ornatus* var *decoratus* Heller cf. *P. versicolor* (Lath), the spiny or Rock lobster is the commoner of the two. Its average length is about 10 inches; weight about 1½ lbs. It inhabits, preferably, the hard and rocky portions below the tidal waters, but is also found in deep water.

(2) *Panulirus fasciatus* (Fabr) is larger in size and inhabits deep water. In colour it is a beautiful purple with darker purple and white bands.

Breeding. Egg-laden females are generally taken from November to January. The male lobster carries what is known as a 'sperm cake' on the ventral surface of the thoraxic region. The larvae pass through a very characteristic form known as the *Phyllosoma* (Fig. 3). Several specimens of this stage were secured by me during the month of October.

Methods of Fishing. Lobster are chiefly caught from November to March, in 'bully nets' locally called *Gadas*, in 'wall seine nets', and in 'lobster pots'.

'Bully nets'—*Gadas* or *Fage.* Small, like a 'tow net', semi-conical in shape, seldom exceeding 2 feet in length with a mouth

1½ feet in diameter. In the centre of the net is tied the bait,—generally fish. The nets are arranged in rows on the sea bottom, at intervals of 10-15 feet, and kept in place by weights. They are hauled up one by one and their contents emptied into the boat. In the case of the 'Wall Seine' the lobsters get entangled in the mesh. These nets are set in localities where lobsters are abundant. The mechanism of 'lobster pot' is that of the ordinary rat-trap. The lobster gets in but cannot get out. It is a box-shaped device with the top and bottom of wood and the sides of netting with one or two funnel-shaped entrances. These traps vary in size. They are left under water and are periodically hauled to the surface and emptied of their contents. After rebaiting, the traps are returned to the bottom.

Value of yield. Bombay Markets are supplied from the following localities. The table shows the amount caught at each place:—

	Lobsters.
Karachi	12,000
Bombay and Salsette Islands ...	10,000
Arnala	1,500
Bassin	2,500
Rewas	5,000
Mora	3,500
Trombay	5,000
Alibag	3,000
Ratnagiri	6,000
Malwan	10,000
Karwar	3,500

Lobsters are sold at the rate of 6-8 annas a pair. The annual catch is estimated at 60,000 along the Bombay coast approximating a value of Rs 15,000.

CONCLUSION.

It is very apparent from the foregoing account that the Shell-fish Industry is an important one both from the economic and academic points of view. I would add that the specimens and results obtained by the survey have fully justified the trouble and expense incurred. It is to be regretted that no regular and accurate statistics are available and, that nothing has so far been done to improve this industry along the Bombay coast. The fishermen are absolutely ignorant of the scientific methods so extensively employed in other maritime countries of the world.

Fisheries along the Bombay coast are carried out on the old fashioned lines, the most primitive methods being employed, in fishing, preserving and the marketing of the products. There is much waste, so much so, that there is no thought of the future which is a very important factor. It may be said of these ignorant folk that they are gradually 'killing the goose that lays the golden egg'. However, in defence of the fishermen, we must ask how much has been done by Government to improve their methods?

Then again the whole case needs a thorough investigation as to the application of methods suitable to local conditions. It is not within the province of Government to undertake capitalistic enterprises, but it is the duty of the State to supply data essential to commercial success.

In order to improve this industry it is essential that the fish themselves must be studied, their distribution, breeding season, development, habit, food, and so on. Migration is an all important factor. A systematic biological study of the species concerned is essential to the better understanding and development of the industry. Our knowledge of the life-history and habits of even the most important forms is very rudimentary and needs further investigation. The edible oyster is the only shell-fish which has been worked out by Awati and myself (2).

The further development of the industry depends on two important points. Russell and Yonge (16) has emphasized that 'Any development of the shell-fish industry is dependent on the solution of two problems of purification and cultivation of which the former is the more pressing but the latter the more fundamental in the long run.'

The shell-fish collected from creeks and backwaters, in the neighbourhood of large towns where the sewage is discharged into the beds (like Bombay and Karachi) stand a very great chance of contamination from the polluted waters passing over them. Shell-fish collected from such areas is likely to be a danger to public health, as potential sources of dysentery and enteric fever. Legislation is necessary to prohibit the sale of shell-fish collected in such localities unless the catches are sterilized.

Artificial cultivation is a practicable proposition, a little care and occasional attention being required during growth to ensure a rich harvest. An idea of this may be gained from the following extract from the official report of the Ministry of Agriculture and Fisheries of Great Britain:—'It has been calculated that an acre of the best mussel grounds will produce annually 40,000 lbs. of mussels, equivalent to 10,000 lbs. of meat with a 'fuel' value of 3,000,000 calories and a money value of about £250, and this at a cost of practically no capital expenditure and only such labour as is involved in transplantation to prevent overcrowding, and to secure the best conditions of growth and fattening. No known system of cultivation of agricultural land can produce corresponding values in the form of animal food.'

It is probable that many of the unproductive shallow waters could be converted into profitable areas if the cultivation of suitable areas was carried out on scientific lines which research alone would be able to achieve.

Public opinion created in the right direction would help to bring about a clearer realisation of the importance of the fisheries and the greater need of concerted and properly directed effort for its preservation and development. Firstly, by working out the Bionomies of the important shell fishes, secondly, by establishing useful and needed legislation for the protection of the industry and lastly, by creating a proper department to look after the interests of the industry. The duty of such a department should be to arouse interest in the shell-fish industry, to adopt measures for its improvement, to teach and encourage the fishermen to use better methods and instruct them how to restock beds. After a survey of the areas, to introduce better methods of farming shell-fish suitable to the various localities and conditions; and better ways of preserving, marketing and despatch of their commodities.

The following suggestions may be of use for the further development of the industry:—

(1) *Statistical inquiry.* As no real progress is possible without an accurate knowledge of the different fisheries, it is essential that such an inquiry should be undertaken by the local Government.

(2) *Experimental Station.* Experimental farms should be established at suitable places which should act as model farms for the benefit of fishermen. At present there exists no experimental station in the Presidency where the study of shell-fish can be carried out. It is essential to establish a well equipped laboratory conducted by a competent staff for the investigation of the problems of the industry.

(3) Methods should be adopted to improve the quality of the shell-fish and thereby increase the output.

(4) *Size limit.* There should be introduced a size limit for all shell fish thereby preventing a waste of immature individuals.

(5) *Close Season.* A close season should be enforced during the spawning period.

(6) *Co-operative Societies* and education for the fishermen should be encouraged to improve moral and material conditions as in the Madras Presidency.

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THE HYDERABAD STATE ORNITHOLOGICAL SURVEY.

BY

SALIM ALI.

With Notes by Hugh Whistler.

PART III.

(*With two plates*).

(*Continued from page* 725, *vol.* xxxvi).

FAMILY: PLOCEIDÆ.

Ploceus philippinus philippinus (Linnæus). The Baya.

Loxia philippina Linn., Syst. Nat., ed. xii, i (1766), p. 305—Philippines *errore*—Ceylon.

Specimens collected: 19 ♀ 27-9-31 Hyderābād City Environs 1,800 ft.; 400 ♂ (imm), 401 ♀ 1-12-31, 437 ♂ 8-12-31 Narsampēt 800 ft.; 489 ♀ 1-3-32 Kandahār 1,400 ft.; 677 ♂ 8-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Jedcherla, Achampēt, Manānūr, Singarenni Collieries, Borgampād, Nelipāka, Pāloncha.

Iris brown; bill yellow, brownish on culmen and tip of lower mandible; mouth pink or brownish-pink in adult, yellowish-pink or yellow in immature; legs and feet pale- to brownish-flesh colour; claws duskier. In No. 489 (albino) iris hazel brown; bill pale yellow; mouth pale pink; legs and feet pinkish-white.

[I have already given in the Eastern Ghats Survey Report (J.B.N.H.S., vol. xxxvi, p. 832) my reasons for considering *Ploceus philippinus* and *P. passerinus* auct. as races of one and the same species.

The name *passerinus* cannot stand vide C. B. Ticehurst, Bull. B.O.C., vol. lii, No. ccclvii, p. 104, who proposes *burmanicus* in lieu of it.—H.W.].

The Baya is generally distributed over the Dominions. However, I found it much commoner in the rice-growing tracts of the Telingāna than in the western and drier portions of the country. Even in the Mahrattwāda it seemed to me to be confined to the neighbourhood of paddy cultivation, which provides it both with food and with nesting material. The stomach of a specimen (No. 677) shot out of a flock feeding on ripening paddy contained 125 grains, which is sufficient indication that the damage they cause must often be considerable. No. 489 was a partial albino and was a conspicuous object even at a distance of over a quarter of a mile! It seemed however to be perfectly healthy and was very fat.

Bayas are popular with bird-fanciers in Hyderābād City and are largely sold in the Chowk Market at prices ranging from 4 annas to 1 rupee or more. They are usually carried about perched on a finger, secured by a string brace which gives them liberty of wing movement. The birds are taught a number of tricks, one of the commonest being to retrieve a ring thrown into a well in mid-air, before it touches the water.

Breeding: The breeding season, as in many other parts of its range, coincides with the South-West Monsoon. The nests, hung chiefly on Babool trees in water-logged fields or over tanks, streams, kutcha wells etc. were in my experience, never in large colonies as is the case in many localities e.g. the Konkan. Ten was the largest number I noted in Hyderābād, and even these were not huddled together but scattered over the tree. Four was the largest clutch of eggs in any one nest, the more usual number being two or three. My observations tended to confirm the findings recorded in my paper on the nesting habits of this species (J.B.N.H.S., vol. xxxiv, pp. 947-957) specially as regards one cock having several hens and nests. Here also, as a general rule, the nests were found to be suspended on the eastern side of the tree presumably for protection from the South-West Monsoon. Paddy leaf constituted the only building material in all the nests examined.

The White-backed Munia (*Uroloncha malabarica*) was everywhere noted as a regular user of Baya nests for laying purposes, some apparently quite new ones, and as I have suggested elsewhere (ibid) it would not be surprising if in course of time this species develops a habit of parasitism on the Baya.

Davidson and Wenden found the Baya breeding in July in the Bhīma Valley (S.F., vii, 85).

Ploceus manyar flaviceps Lesson. The Striated Weaver-Bird.

Ploceus flaviceps Lesson, Traité d'Orn. (1831), p. 435 ex Cuvier MS.—Pondicherry.

Not met with by the Survey, but Col. Sparrow's collection contains the following specimens from Hyderābād: ♂ 11-7-12, ♂ 31-7-14 Trimulgherry.

[It is by no means certain that there are two races in India (vide Ticehurst, Ibis 1922, p. 645) and a good series from Travancore and South India is necessary to settle the point. The above specimens are too worn for the purpose.—H.W.]

Munia malacca (Linnæus). The Black-headed Munia.

Loxia malacca Linn., Syst. Nat., ed. xii, vol. i (1776), p. 302—China, Java and Malacca *errore*—Belgaum.

On 7 December a flock of about 15 birds was observed in tall rank grass on marshy savannah land near Pākhāl Lake, in company with *Uroloncha malabrica* and *U. punctulata*.

[The nearest locality where this species was known to me to occur was Kolair Lake, between the Godāvari and the Krishna, where Col. Sparrow met it and obtained specimens in January and February 1913.—H.W.]

Uroloncha malabarica (Linn.) The White-throated Munia.

Loxia malabarica Linn., Syst. Nat., ed. x, vol. i (January 1758), p. 175—India, Malabar Coast.

Specimens collected: 15 ♀, 16 ♂ 27-9-31 Hyderābād City Environs 1,800 ft.

Elsewhere noted at: Manānūr, Singarenni Collieries, Borgampād, Nelipāka, Pāloncha, Narasampēt, Pākhāl Lake, Āsifābād, Utnoor, Kandahār, Kannad.

Iris dark brown; bill slaty-blue; legs, feet and claws purplish-pink.

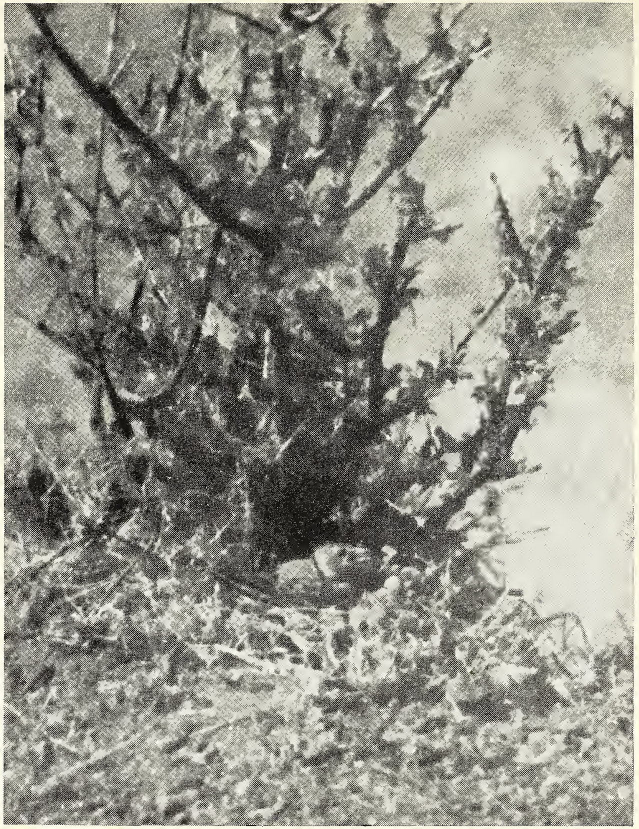
[This species has no races. I have seen specimens in the Sparrow Collection from Dichpalli, Navidet and Trimulgherry and in Col. Baker's collection from Aurangābād.—H.W.]

This Munia is a very common resident species throughout the State. It affects orchards, open grasslands or cultivated country and its neighbourhood, and is usually met with in flocks of upto 20 birds. Old Baya nests are habitually used as dormitories, as many as six birds frequently occupying a single nest. All such nests examined had holes bored near the egg chamber which served as exit.

Breeding: No. 15 (27 September) had soft eggs in the ovaries, while in No. 16 (its pair) the testes were enlarged to breeding size, measuring ca. 6×4 mm. The birds were busy building in a small lime tree.

On 29 October (Borgampād) a nest was found containing 4 full-fledged chicks ready to leave in a couple of days. Between 30 October and 6 November many fresh eggs were found in disused Baya nests. This was also noted subsequently at Pāloncha and elsewhere. It appears to have become a regular habit with this species to utilise Baya nests for laying purposes, and legitimate Munia nests were rarely observed in localities where these were available. It is always possible to tell where a Baya nest has been used for rearing a brood of Munias by the masses of filth left behind by the birds. Unlike the Baya, this species does not seem to bother about removing the excreta of the chicks. The same is the case with their own nests too.

On 14 November a pair was observed building at Nelipāka. The breeding season appeared to be in full swing between September and November, but as elsewhere, it is probably not strictly confined to any particular period. The nests, when made by the birds themselves, are untidy globular structures of grass &c. with entrance at the side. They are placed in *Ber* or Babool bushes and the like (usually between 5 and 10 feet high) growing in fields



Photos by *Author.*

1. Yellow-throated Sparrow (*Gymnorhis xanthocollis*) at nest.

2. Nest of the Black-bellied Finch-Lark (*Eremopterix grisea.*)

(Note bird—female—panting with the heat; shade temperature *ca* 100° F.).

and on bunds &c. In the cotton-growing districts of the Mahrattwāda (Nāndēr, Parbhani &c.) the nests were often composed exclusively of cotton-wool filched from neighbouring fields. I have frequently flushed three or four birds from a single nest containing fresh eggs, and it may be that at times nests are used as dormitories even while a clutch is being incubated. None of the nests examined in the Hyderābād State contained more than 4 eggs or chicks.

Davidson and Wenden (S.F., vii, 85) found it breeding at all seasons in the Bhīma Valley.

Uroloncha punctualata lineoventer (Hodgson). The Spotted Munia.

Munia lineoventer Hodgson, As. Res., xix, pt. i (October 1836), p. 154—Nepal.

Specimens collected: 235 ♀ 3-11-31 Borgampād 160 ft.; 294 ♂ (imm), 295 ? (imm) 12-11-31 Nelipāka 160 ft.; 378 ♂ 26-11-31 Pāloncha 300 ft.

Elsewhere noted at: Manānūr, Pākhāl Lake, Narsampēt.

Iris orange- or reddish-brown; bill slaty-black; mouth slaty with prominent cream coloured crescent on palate; legs, feet and claws slate colour.

In immature birds (Nos. 294 and 295): Iris brown; bill horny-brown, paler on lower mandible; gape pale yellow; mouth pale yellow with slate coloured crescent on palate; legs and feet bluish-grey; claws duskier.

[Himalayan and Indian continental birds are the same, and Kloss (Treubia, xiii, p. 363 (1932)) has shown that the above is the correct name for them. There is a specimen from Hyderābād State in Col. Sparrow's collection labelled: ♂ 31-8-12 Mulkaram.—H.W.]

The Spotted Munia is much less common and more restricted in its distribution than the preceding species; at all events, I met with it only in the eastern and southern (afforested) portions of the State having obtained no record from the Nāndēr and Aurangābād Districts. It was also noted as keeping in flocks and inhabiting the same sort of country as the White-throated Munia.

In the Bhīma Valley, Davidson and Wenden (S.F., vii, 85) found it a common breeding species. Fairbank (S.F., iv, 260) considered it rare in the Ahmadnagar District while at Poona, Betham (J.B.N.H.S., xiii, 687) records it as fairly plentiful during the monsoon but disappearing with the rains. He believed however that a few did remain to breed.

Breeding: Nos. 294 and 295 (12 November) were immature birds with imperfectly ossified skulls and in the plain brown juvenile plumage. Many examples in this phase of plumage were noted amongst the flocks at this period. No. 378 (26 November) had the testes enlarged to 8×5 mm. and was obviously breeding, while on 8 December (Narsampēt) I followed a bird carrying nesting material to a *Ber* bush with 2 partly completed nests within a foot of each other, at a height of about 7 feet from the ground. They were the usual Munia structures—untidy balls of grass.

In Poona the breeding season is August and September according to Betham (J.B.N.H.S., xiv, 398). In the neighbourhood of Bombay and in the Konkan (Kolāba District) I have found it nesting between July and October.

Stictospiza formosa (Latham). The Green Munia.

Fringilla formosa Latham, Index Orn., vol, i (1790) p. 441—India.

I did not personally come across this bird in the Hyderābād State, but the Gond Raja at Utnoor who takes a rather more than casual interest in his surroundings, described it to me so accurately that I cannot help including it in this list. He was shown a female Red Munia to test whether he really knew his bird, but he stoutly maintained that the other was quite different and described it unmistakably. It is said to frequent tall grass in that locality.

[It is recorded from Chānda in the Central Provinces ('I met with this rather scarce bird in the Chānda Forest region on the Pranhita near Ahiri always in or near forest'—Blanford, J.A.S.B., 1869, p. 186) and the Wardha Valley ('Only found east of the Wardha and very local'—Blanford, J.A.S.B., 1871, p. 274); also ♂ 14-4-67 and ♂ 28-4-74 Pranhita (Hume Collection—B.M.)—on the one border and on the other border in the Konkan (Lloyd, List of Konkan Species) and near Mahābleshwar 'rare' (Fairbank, S.F., iv, 261).—H.W.]

Amandava amandava amandava Linnæus. The Red Munia.

Fringilla amandava Linn., Syst. Nat., ed. x, vol. i (1758), p. 180—India orientalis—Northern Guzerat (restricted in the Eastern Ghats Survey Report).

Specimens collected: 446 ? (imm) 8-12-31 Narsampēt 800 ft; 671 ♂, 672 ♀, 673 ♂, 674 ♀ 675 ?, 676 ? (imm) 8-4-32 Utnoor 1,250 ft.

Elsewhere not noted.

Iris hazel brown or brownish-orange; bill blackish-brown in very young birds, changing to reddish-brown; in adults or nearly grown birds bright coral red, blackish on culmen; mouth in immature bird (No. 446) pale yellow with tiny slate-coloured spots; legs and feet brownish- or pinkish-flesh colour; claws brown.

Not common. Small flocks of 5 to 12 birds were observed in tall grass country and in the neighbourhood of swampy paddy cultivation. Stomachs of the specimens contained grass seeds almost exclusively. Their gonads were in an undeveloped condition.

According to Blanford (J.A.S.B., 1871, 274) it occurs in the Wardha Valley, and Betham who found it plentiful in and around Poona (J.B.N.H.S., xiii, pp. 381 and 686) says it breeds there in October.

Carpodacus erythrinus roseatus (Blyth). The Common Indian Rose-Finch.

Erythrospiza roseata Blyth, J.A.S.B., 1842, p. 461—Calcutta.

Specimens collected: 439 ♂, 440 ? (imm), 441 ♀ 8-12-31 Narsampēt 800 ft.

Elsewhere not noted.

Iris pale brown; bill pale horny-brown; mouth pale pink; legs, feet and claws pale horny-brown.

A winter visitor to Peninsular India and Hyderābād State. Not common. Flocks of 10 to 15 birds were seen in scrub country in the neighbourhood of the town. All the specimens were in heavy general moult. No. 440 had the skull imperfectly ossified and was a first winter bird.

[This Rose-Finch is an unusually late migrant to arrive in Southern India and it should be possible to correlate this fact with the seeding and flowering seasons of certain crops and bamboos in Northern and Central India.—H.W.]

Gymnorhis xanthocollis xanthocollis (Burton). The Yellow-throated Sparrow.

Fringilla xanthocollis Burton, Cat. Birds, Mus. Fort Pitt, Chatham (1838), p. 23—Ganges between Calcutta and Benares.

Specimens collected: 106 ♂ 12-10-31 Manānūr 2,000 ft.; 397 ♂, 1-12-31 Narsampēt 800 ft.; 578 ♀ 19-3-32 Kaulās 1,350 ft.; 660 ♂ 6-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Borgampād, Nelipāka, Āsifābād, Kandahār, Aurangābād, Bhamarvādi. The Sparrow Collection contains specimens from Nāndēr, Kharkheli and Eswantarāopet.

Iris brown or hazel brown; bill pale horny-brown, paler (blue-grey) at base; bill in breeding season (♂) blackish-brown; mouth greyish-pink; legs, feet and claws greyish-brown.

The Yellow-throated Sparrow is commonly distributed throughout the Dominions. My impression is that it is a resident species here though there are vague suggestions by various authors such as Vidal (South Konkan, S.F., ix, 72), Butler (Deccan and S. Mahratta Country, S.F., ix, 416), Whitehead (Sehore, J.B.N.H.S., xxi, 162) and Briggs (Mhow, J.B.N.H.S., xxxv, 390) to the effect that it is wholly or partially migratory in those areas. This is a point that needs settling by careful observation.

It frequents the neighbourhood of cultivation and scrub jungle, as well as deciduous forest, being met with in flocks of upto 30 birds or more during winter but breaking up into pairs with the approach of the hot weather. At Utnoor I have recorded it as the commonest bird in the deciduous forest. The flocks retire into shady bushes or leafy *Ber* trees during the heat of the day and indulge in much chattering and chirruping. They are very partial to the flowers of the Mhowa (*Bassia latifolia*) on which they feed extensively in the season. Even after the flocks have broken up, 10 or 12 birds may frequently be seen feeding together on the ground.

Breeding: March and April appear to be the months when breeding is at its height. In the specimens obtained prior to 19 March the gonads were in an undeveloped condition. No, 578 (19 March) had soft ovarian eggs and was breeding; it had a prominent incubation patch on the abdomen and a similar dishevelled thinly feathered patch on the back caused presumably by the treading of the cock. The testes of No. 660 (6 April) measured ca. 8×5 mm. Numerous pairs were observed in copula at this period. Unlike the House Sparrow, the cock flies directly on to the hen's back from a neighbouring branch and returns to the same or a similar perch before repeating the operation, 3 or 4 times, at intervals of half a minute or so.

At Utnoor, Kannad and Bhāmarvādi, between 1 and 29 April, these Sparrows were observed nesting in holes in rotten trees all over the forest. The nest is usually an untidy pad of grass and feathers at the bottom of a hollow.

Passer domesticus indicus Jardine & Selby. The Indian House Sparrow.

Passer indicus Jardine & Selby, Illustr. Orn., vol. iii, pl. 118 (1835)—India Bangalore.

Specimens collected: 21 ♂, 22 ♂ (juv.) 30-9-31 Hyderābād City; 197 ♂ (imm.), 198 ♀? (imm.), 199 ♂? (imm.) 30-10-31 Borgampād 160 ft; 302 ♀ 13-11-31 Nelipāka 160 ft.; 395 ♂ (imm.), 396 ♀ 1-12-31 Narsampēt 800 ft.; 693 ♂ (imm?) 16-4-32, 706 ♀, 707 ♂ 17-4-32 Kannad 2,000 ft.

Iris brown; bill, in adult pale horny-brown, in immature more flesh-coloured; mouth, in adult pale pink, in immature yellowish-pink with lemon-yellow gape; legs and feet brownish flesh-colour; claws duskier.

[In the new *Fauna* (Vol. iii, pp. 170-172) Mr. Stuart Baker divides the Indian House-Sparrow into a Northern and a Southern race, the differences given being apparently both of colour and size. I regret that I am quite unable to agree with this. I have carefully compared the Hyderābād Survey series, together with others in the British Museum and elsewhere from southern India, with a good series from northern India and I can find no difference at all in colour, so long as birds in a corresponding state of wear are considered. The colour differences relied on by Mr. Stuart Baker appear to be purely seasonal, depending on the state of wear. As regards size, I measure two series as follows:

	Bill from skull.	Wing.	Tail.
12 ♂♂ S. India.	13-15	71.5-78.5	49-57.5 mm.
12 ♂♂ N.W. India.	13-15	75-79	54-58 mm.

and the proportionate between these two measurements is maintained however many other birds are measured until one reaches the outer Himalayan races when intergrading with the larger *P. d. parkini* of the Trans-Himalayas commences.

In any case Mr. Stuart Baker was wrong in calling his Northern race *P. d. indicus* and his Southern race *P. d. confucius.* Apart from the fact, pointed out by Dr. C. B. Ticehurst (J.B.N.H.S., xxxii, 346), that if the Burmese and South Indian House-Sparrows are really the same bird, *Passer confucius* Bonaparte is antedated by *Pyrgita nigricollis* Burton, Mr. Stuart Baker could not restrict the type-locality of *Passer indicus* to Karachi to use it for his Northern race for Jardine and Selby's description was taken from a bird from Bangalore, namely the male of a pair collected there for Selby by a Lieut. Atherton (vide Kinnear, Ibis 1925, p. 751).—H.W.].

A very common resident throughout the State in towns and villages. It had not yet penetrated to Farāhābād which is a small Bhīl hamlet of some 6 or 8 hovels in the midst of dense forest.

Breeding: I am doubtful if the House-Sparrow has anything like a definite breeding season. All the time I was in Hyderābād (September to May) the breeding was certainly in full swing. The nest is built in any convenient hole in buildings or under rafters, and every Dāk Bungalow invariably holds its quota.

A pair at Saifābād attempted for well over a month (January-February) to build on the wooden battens casing electric wires in the drawing room. The available surface was barely two inches wide and the natural result was that as soon as a couple of grasses were collected they fell down. The birds persisted day after day from morning till night, and every evening a small basketful of rubbish had to be removed from underneath the impossible site!

The organs of the specimens were as follows: No. 21 (30 September) testes ca. 6×4 mm.; 395 (30 November) testes ca. 10×5 mm.; 396 (30 November) one full sized and other smaller soft eggs in ovary; 693 (16 April) testes ca. 7×6 mm.; 706 (17 April) ovarian follicles ca. 1-1.5 mm.; 707 (17 April) testes ca. 6×4 mm. In the rest the gonads were in an undeveloped condition; those of 302 (13 November) had apparently reverted to normal size, but she was busy feeding chicks in the thatch of our ceiling.

An extraordinary fact was brought to light by a careful dissection of the specimens which suggests that young cocks begin to breed soon after assuming adult plumage, even before their skulls are perfectly ossified. Thus No. 395 (testes 10×5 mm., adult plumage) was observed in copula with No. 396 (organs, see above). The birds were captured immediately after the act, and the skull of the male was found to be distinctly soft in the centre. On the abdomen of the female was a prominent incubation patch indicating that she was brooding. Similarly No. 693 (organs, see above) who was the owner of a nest in the rafters of the Kannad Dāk Bungalow also had an unossified patch in the centre of its skull.

Copulation appears to continue from the 'pre-œstral' period right through, till well after the chicks are born. A pair who had a nest in a thatch ceiling containing two naked chicks just hatched and two eggs on the point of hatching (Deglūr, 14 March) were repeatedly observed in copula. This was also the case with another pair the parents of a nest of cheeping young among the rafters. A male was once observed feeding a full-fledged young out of the nest, the female parent not being in evidence.

At the end of April I noted that the female of a pair having a nest behind a picture on the drawing room wall in a bungalow at Saifābād, regularly captured moths and other insects coming to the electric light and fed them to the clamouring brood often upto 10 o' clock at night when the lights were turned off. If this is not an isolated instance then surely we have a breed of super-sparrows in the making which keeping pace with human ingenuity are striving to break through the restrictions imposed upon their activities by natural causes such as failure of daylight![1]

Four is the largest clutch of eggs or brood of young that came under my notice in Hyderābād.

Emberiza buchanani Blyth. The Grey-necked Bunting.

Emberiza buchanani Blyth, J.A.S.B., vol. xiii (1844), p. 957—Afghānistān.

Specimens collected: 485 ♂, 486 ♀ 1-3-32, 497 ♀ 2-3-32 Kandahār 1,400 ft.; 690 ♀, 691 ♀ 14-4-32 Aurangābād 2,000 ft.; 710 ♀, 711 ? 18-4-32 Kannad 2,000 ft.

Elsewhere noted at Āsifābād. Specimen ♀ 18-1-11 Karkah (?) in Sparrow Coll.

Iris brown; bill pale brownish-yellow or brownish orange-yellow; mouth yellowish flesh-colour; legs and feet brownish flesh-colour.

Winter visitor. Flocks of from 8 to 20 birds, sometimes in company with *Emberiza icterica*, were observed feeding in open stubble country or on broken hillsides with sparse stunted thorn or *Opuntia* bushes. The flight, gait and general behaviour are very like those of the Pipits (*Anthus*) but the white ring round the eyes is conspicuous as also is the distinctly forked tail, especially in flight. The birds appeared to be shy on the whole.

The gonads of the specimens were in non-breeding condition, but Nos. 690 and 691 (14 April) and 710 and 711 (18 April) were all very fat. This, coupled with the fact that the birds were in freshly moulted plumage suggested that they were preparing to emigrate to their northern breeding grounds.

Emberiza melanocephala Scopoli. The Black-headed Bunting.

Emberiza melanocephala Scopoli, Annus i, Hist. Nat. (1769), p. 142—Carniola.

I did not come across this Bunting in the Hyderābād State, but Mrs. Tasker, who has been good enough to let me see her field notes, has recorded it from Mālegāon (Nāndēr District) on 30-12-29. There are, moreover, two specimens in the Sparrow Collection labelled: ♂ 13-1-11 Manwath Road, and ♂ 30-1-11 Pārtūr.

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[1] Since the above went to press, I have had occasion to observe identical behaviour in the case of another ♀ in Dehra Dun, U. P.

It is a common winter visitor to the Deccan being recorded as such in the Bhīma Valley by Davidson and Wenden (S.F., vii, 85) and in the Deccan and Southern Mahrātta Country by Butler (S.F., ix, 417). In Ahmadnagar District also it appears in flocks (Fairbank, S.F., iv, 261).

Emberiza icterica Eversmann. The Red-headed Bunting.

Emberiza icterica Eversmann, Vehan. Zap. Kazansk. Univ., 1841 (1), p. 161—Rocky eastern shores of Caspian Sea.

In my diary of 15 October (1925) I have a record of a small flock observed on the way from Nerargonda to Talāmadri village en route to Utnoor. I noted small flocks again on several occasions in cultivated country in March (1932) near Kandahār, sometimes in company with *E. buchanani,* and Mrs. Tasker has it in her list for Mālegāon (Nāndēr District) 30-12-29.

The Sparrow Collection contains the following specimens: ♂♂ 28-1-12, ♂ ♀ 22-12-10, ♂ 27-12-10, ♀ 2-2-11 Trimulgherry.

Winter visitor. In the Ahmadnagar District, Faibrank met with odd birds occasionally, especially in the eastern part of the district (S.F., iv, 261). Davidson observed it at Akulkote in February (S.F., vii, 85), while Butler records it as common at Belgaum (S.F., ix, 417).

Melophus lathami subcristata (Sykes). The Crested Bunting.

Emberiza subcristata Sykes, P.Z.S., 1832 (July 31), p. 93—Dukhun.

Specimens collected: 712 ♂ 18-4-32 Kannad 2,000 ft.; 718 ♂, 719 ♂ 20-4-32, 730 ♀, 731 ♀ 21-4-32, 732 ♀ 22-4-32 Bhāmarvādi 2,500 ft.

Elsewhere not noted.

Iris brown; bill dull orange-brown; mouth pale pink; legs and feet purplish-brown; claws brown.

[The old familiar name of both editions of the *Fauna, Melophus melanicterus,* can no longer be used for the Crested Bunting of India. Hume first of all (S.F., vii, pp. 517-8) and Dr. C. B. Ticehurst later (Bull. B.O.C., vol. liii, No. ccclxii, p. 15) showed that the *Fringilla melanictera* Gmelin is not the Crested Bunting at all but some species of *Hypochera* from Africa. In its place *Emberiza lathami* Gray (Zool. Misc., February 19, 1831, p. 2—China and India, type in the British Museum collected by J. R. Reeves at Canton) should be used. In checking the Survey series I have compared Indian and Chinese birds and find that they must be separated as different races. The Indian race differs from the Chinese race in the shorter finer beak, in the more uniform and more glossy black of the upper parts on which the brown fringes to the feathers are greatly reduced or even absent, in having the undertail coverts usually black or black fringed with chestnut in place of chestnut with pale fringes. In the female the underparts are browner, not so yellowish-fulvous.

Emberiza cristata Vigors, P.Z.S. 1830-31, p. 35 (Himalayas) is preoccupied by *E. cristata* Swainson, Zool. Ill. 1823, iii, p. 148 (=*Gubernatrix cristata*) so the first available name for the Indian race will be that of Sykes, above.—H.W.]

At Kannad I only came across a single pair on a stony hillside with cactus and light scrub, of which the male (No. 712) was secured. No others were seen; yet at Bhāmarvādi, only 8 miles to the north, these Buntings were found to be abundant, parties of 4 or 5—on one occasion 10—being commonly met feeding on the ground close to the bungalow or on the Outram Ghāt motor road. In these flocks I remarked that there was a large excess of males over females. Unlike the Kannad pair, the birds here were tame and confiding.

Breeding: No. 712 (18 April) had the testes measuring ca. 4×2 mm., and they appeared to be enlarging. The bird was singing excitedly from his perch on a branch every few seconds, for over ten minutes at a stretch, while the hen fed on the ground nearby. The song is of several pleasant notes, very similar to that of *Saxicoloides* but with this peculiarity that it invariably commences with a detached single—sometimes double—*chick.*

This species is not uncommon in the neighbourhood of Poona (Barnes, J.B.N.H.S., v, 320 and Butler, S.F., viii, 339). The breeding season at Satāra according to Betham (J.B.N.H.S., xiv, 399) is June and July. At Panchgani

4,400 ft. in the Western Ghats, I have taken nests with eggs (usually two) from June till the end of August.

The note commonly uttered as the birds move about on the ground, and in flight, is a *pink-pink* like a Munia but louder.

FAMILY: HIRUNDINIDÆ.

Krimnochelidon concolor (Sykes). The Dusky Crag-Martin.

Hirundo concolor Sykes, P.Z.S., 1832 (July 31), p. 83—Poorundhur 4,000 ft. on the Western Ghats.

Specimens collected: 493 ♀, 494 ♂ 2-3-32 Kandahār 1,400 ft. In the Baker Collection there is a specimen labelled: ♀ 29-8-07 Aurangābād.

Elsewhere noted at: Hyderābād City Environs (boulder hillocks near Mīr Ālam Tank), Nīrmal, Aurangābād, Ellora Caves, Kannad, Bhāmarvādi.

Iris dark brown; bill blackish-brown; mouth pinkish-grey; legs and feet pinkish-brown; claws brown.

A resident species, frequenting boulder hillocks, rock caves and ruins of forts and the like, usually in pairs or small parties of 4 or 5 birds.

Breeding: The ovaries of No. 493 were in an undeveloped condition, but the testes of the male (4×2 mm.) were firm in texture and appeared to be enlarging.

A disused nest was examined in a deserted overgrown ruin, attached to the wall under an arch. It was an oval saucer 5 in. long × 3 in. wide composed of mud-pellets. A clearance of 1½ in. was left between the top of the saucer and the arch. The depression was lined with soft fine tow-like rootlets, supplemented by feathers of parakeets and other birds.

Davidson and Wendon (S.F., vii, 77) found this species breeding in abundance in the Sholāpur District in the rains and in February, and at Egatpoora in the W. Ghats in the middle of March and again in the first week of August. In the Hyderābād State we have breeding records from Secunderābad (Bates, J.B.N.H.S., xxxi, 287) and Jālna (Jerdon, B. of I., i, 165).

Hirundo rustica gutturalis Scop. The Common Swallow.

Hirundo gutturalis Scopoli, Del. Flor. et Faun. Insub., vol. ii, (1786), p. 96—Antique in Panay.

Specimen collected: 64 ♀ 18-10-31 Manānūr 2,000 ft.

Elsewhere noted at: Borgampād, Nelipāka, Kaulās.

Iris dark brown; bill, legs, feet and claws dark horny-brown; mouth pale lemon-yellow.

[The single specimen obtained (Wing 111, tail 40.5-89 mm.) appears to belong to this form rather than the typical, and this is what I should expect from my knowledge of the distribution of the two forms in the Peninsula. The great majority of swallows in collections from the Indian Peninsula are either in moult or in juvenile dress which renders racial identification very hazardous; we shall not, therefore, be able to understand the respective distributions of the two forms properly until more adults in good plumage are obtained. Both forms may occur in Hyderābād.—H.W.]

Usually seen hawking insects gregariously near or over water. At Manānūr I observed a party skimming over the surface of a jheel for insects. It was noted that the birds flew up wind with slow and deliberate wing beats, scanning the surface and scooping up insects, while after a certain distance they wheeled round and shot back to the starting point, aided by the wind, without attempting to pick up insects on the way. From here they gradually worked their way up again taking full advantage of the wind resistance.

In the beds of 'Tamarisk' (*Phyllanthus Lawii*) growing in the Godāvari River at Nelipāka, thousands of these swallows gathered every night to roost in company with Wagtails, Reed-warblers, Wire-tailed Swallows and numerous other small birds.

The ovaries of the specimen were in a quiescent state.

Hirundo smithii filifera Stephens. The Wire-tailed Swallow.

Hirundo filifera Stephens in Shaw's Gen. Zool. vol. xiii (2), (1826), p. 78—India.

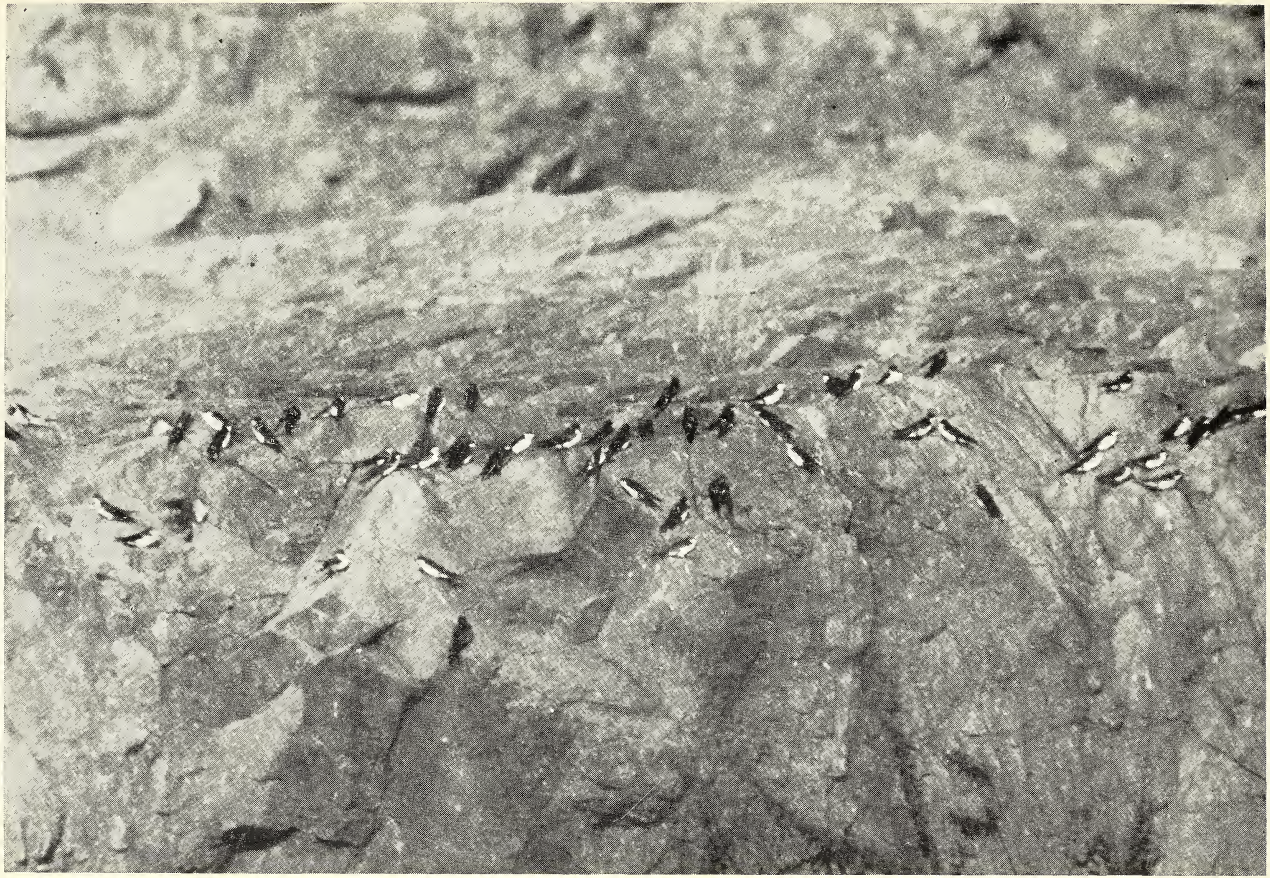

Photo by *Author.*

A congregation of Wire-tailed Swallows (*Hirundo smithii filifera*) on the rocks of the Patālganga Gorge at Deglūr (Nāndēr Dist.).

Specimens collected: 529 ♂ 9-3-32 Mūkhēr 1,350 ft; 699 ♀ 16-4-32 Kannad 2,000 ft.

Iris brown; bill, legs, feet and claws blackish-brown; mouth pale lemon yellow.

Other specimens from Hyderābād seen as follows: ♂ 15-2-11, ♀ 17-2-11 Malapet and Bhiknūr, (Sparrow Collection); ♂ juv. 22-5-07 Aurangābād (Baker Collection.)

A generally distributed and common resident throughout the Dominions, usually met with flying over ploughed fields, pools, jheels and in the neighbourhood of water generally. At Nelipāka, large numbers resorted to the Tamarisk beds in the Godāvari to roost every night, while a great many were observed to congregate on the rocks of the Pātalganga Gorge near Deglūr regularly. My impression however is that usually they keep together in smaller numbers than the preceding species. The assemblages at the Pātalganga Gorge included many full-fledged young without the 'wires' in their tails, with greyish-sooty or dull brown heads and much of the steel blue of the adult plumage replaced by sooty. Many of the youngsters kept tugging playfully at the wires of their elders' tails—literally wire-pulling!

Breeding: Specimen No. 529 (9 March) had the testes enlarged to 6×4 mm. and was obviously breeding. On the same date a pair of full-fledged chicks were observed being tended by their parents. At Deglūr (12-17 March) many such young birds were observed among the colony at the Pātalganga Gorge whose steep rocky sides afforded suitable nesting sites. Many disused nests were seen attached to the rocks here, and on 13 March a pair was observed busy repairing one of these—an oval saucer of mud-pellets about 5 ins. × 3 ins.—The mass of white excreta adhering to the rock-wall under one end of this nest indicated that the preparations were for a second brood.

No. 699 (16 April) had the ovaries in a quiescent state.

A full account of its habits is given by Aitken (S.F., iii, 212). According to him it is a resident in Berār and breeds there from February to June.

Hirundo fluvicola Blyth. The Cliff Swallow.

Hirundo fluvicola Blyth, J.A.S.B., vol. xxiv (1855), p. 471—Bundelkund.

The following specimens from Hyderābād State and neighbouring areas examined; ♂ and 3 ♀♀ 14-11-10 Trimulgherry; ♀ 3-2-11 Purnah (Sparrow Collection); ♂♀ 13-1-71, ♀ ?-1-71 Dumāgudiam (Blanford, British Museum Coll.).

Not met with by the Survey.

This species occurs in Satāra and Sholāpūr and is common but local in Nāsik (Barnes, J.B.N.H.S., iv, 2). According to Butler (S.F., vii, 76) it breeds in great numbers under the railway arch over the Sholāpūr tank. It also breeds about Poona (Betham, J.B.N.H.S., xii, 781), while in Berar, Aitken (S.F., ii, 213) found it breeding at Akola. They build here directly after the rains and also have a second brood in February.

Hirundo daurica erythropygia Sykes. The Striated Swallow.

Hirundo erythropygia Sykes, P.Z.S., 1832 (July 31), p. 83—Poona.

Specimens collected: 495 ♂ 2-3-32 Kandahār 1,400 ft.; 613 ♀, 614♂ 26-3-32 Kaulās 1,350 ft. Also ♂ 25-1-11 Jālna, in Sparrow Collection.

Elsewhere noted at: Manānūr (Mrs. Tasker!), Deglūr, Utnoor, Aurangābād, Kannad, Daulatābād Fort.

Iris brown; bill, legs, feet and claws brownish-black; mouth pale yellowish-grey.

A fairly common resident species. Frequents ruined forts, mosques and buildings. It was also occasionally met with in deciduous forest where small flocks were seen perched on the bare topmost branches of some tree, sallying forth every now and again to hawk winged insects.

Blanford (J.A.S.B., 1869, p. 172) and Aitken (S.F., iii, 212) in Berar and Sykes in Poona (P.Z.S., 1832-33) have commented upon the appearance of enormous flocks of Striated Swallows during the winter months, and in the Konkan I have myself observed similar gatherings in the Kolāba District at the same season. The birds are specially partial to telegraph or power transmission wires, and early one January morning (before 8-30) I noted an immense concourse of this nature with the birds closely huddled together, occupying several hundred yards of the line! The birds dispersed for feeding as the sun rose higher and the flock had evidently moved further afield during the day as there were none about the place when visited again at dusk.

In Mr. Whistler's experience, however, the race comprising such large flocks is usually either *nepalensis* or *japonica* both of which are migratory species and winter visitants to peninsular India.

Breeding: Specimen No. 495 (2 March) had the testes in an undeveloped condition, but the gonads of 613 and 614 (26 March) showed a tendency towards enlargement, those of the ♂ measuring 4×3 mm.

Aitken (ibid) found it breeding in Berār and it is more than likely that it does so in the Hyderābād State also. In the Konkān I have taken eggs in May.

FAMILY: MOTACILLIDÆ.

Motacilla alba dukhunensis Sykes. The Indian White Wagtail.

Motacilla dukhunensis Sykes, P.Z.S., 1832 (July 31), p. 91—Dukhun.

Specimens collected: 190 ♂ (imm) 29-10-31 Borgampād 160 ft.; 322 ♀ (imm), 323 ♀ (imm) 16-11-31 Nelipāka 160 ft. The Sparrow Collection contains the following: ♀ 26-3-11, ♀ 11-11-12 Trimulgherry; ♀ 25-1-11 Jālna; ♀ 10-2-11 Bāsar.

Iris brown; bill, legs, feet and claws brownish-black; mouth yellow and greyish-pink or greyish-pink; gape in 190 bright yellow.

A common cold weather visitor throughout the Dominions. Last seen 17 March (Deglūr). Sykes (P.Z.S., 1832, 91) describes it as the most common and abundant wagtail in the Deccan. The Survey found it very common at Nelipāka where large numbers were regularly observed on the grassy mudbanks of the Godāvari River feeding in company with other wagtails. At night they roosted by the hundred among the dense tamarisk beds.

All the specimens were immature with skulls in varying stages of ossification.

Motacilla maderaspatensis Gmelin. The Large Pied Wagtail.

Motacilla maderaspatensis Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 961—India.

Specimens collected: 30 ♀, 31 ♂ 5-10-31 Mananūr 2,000 ft.; 201 ♀ 30-10-31 Borgampād 160 ft. Other specimens examined: ♂ 2-1-71 Dumagudiam (Blanford) and ♂ 23-11-69, ♀ 25-10-69 Secunderābād (Slaughter) in B. M. Collection; ♂ 28-10-06, ♀ 30-9-06 Aurangābād in H. R. Baker's collection.

Elsewhere noted at: Hyderābād City and Environs, Dornākal, Kāzipet, Singarenni Collieries, Nelipāka, Narsampēt, Āsifābād, Kandahār, Mūkhēr, Deglūr, Nirmal, Kannad.

Iris brown; bill horny-black; mouth slaty-black; legs, feet and claws horny-black.

[As I have shown in the Eastern Ghats Survey Report (Vol. xxxvi, p. 842) this is not a race of *Motacilla alba*.—H. W.].

The Large Pied Wagtail is commonly distributed throughout the Hyderābād State where it is resident. It is usually met with in pairs in the neighbourhood of streams, jheels and village tanks etc., especially those partly dry with shingly or rocky beds. It often frequents the vicinity of human habitations where it may commonly be seen perched on roof-tops and the like.

At Nelipāka many pairs were regularly observed feeding on the mudbanks of the Godāvari River in company with other wagtails. Every now and again a bird, or a pair, would fly out over the water chasing one another or members of other pairs, but I never saw them cross over to the opposite bank into British territory. Both chaser and chased invariably wheeled round when about midstream and returned to Nizam's territory! At night the birds resorted to the Tamarisk (*Phyllanthus Lawii*) beds to roost in mixed company.

The song uttered by the male at most seasons, but chiefly with the advent of breeding, is pleasant and sweet, in parts not unlike that of the Magpie Robin (*Copsychus*).

Breeding: The gonads of the specimens (all October) were in an undeveloped condition. Between 6 and 10 March I observed at Mūkhēr that almost every masonry well had a pair in occupation, and that the males were generally singing from the tops of wooden stakes of the water-lifting gear or thereabouts.

On 16 March (Deglūr) two pairs were observed building at the base of tussocks of grass growing out of the crevices in a rock midstream in the Pātalganga Gorge. The material employed consisted chiefly of scabs of algae from drying-up pools in the river bed, and other rubbish which in one case was a piece of old fine-meshed fishing net. The two nests were within 3 feet of each other. On 12 April (Nīrmal) a nest was found at the base of a tussock of grass growing from a crevice in a rock in a roadside pool. The nest was a pad of roots, hairs, wool etc., with a cup-like depression in the centre. It contained 4 eggs—3 hardset, 1 cracked and addled. They measured 21×15 mm. (3) and 20×15 mm. (1). In appearance the eggs were very like those of the House-Sparrow—greyish-white with brown specks all over, specially thick round the broad end.

According to Davidson and Wenden (S.F., vii, 84) the Pied Wagtail breeds in the Deccan (i.e. the Bhīma Valley, principally) in the cold weather and rains. In the neighbourhood of Poona, Betham (J.B.N.H.S., xiii, 381 and 687) found it breeding in March. He also took 2 clutches of 4 eggs each on 14 and 26 September.

Motacilla cinerea caspica S. G. Gmelin. The Eastern Grey Wagtail.

Parus caspicus S. G. Gmelin, Reise Russ., vol. iii (1774) p. 104, pl. 20, fig. 2—Caspian Sea.

Specimens collected: 135 ♀ 16-10-31 Farāhābād 2,800 ft.; 438 ♀ 8-12-31 Narsampēt 800 ft.; 624 ♀ 1-4-32 Utnoor 1,250 ft.; 700 ♀ 16-4-32 Kannad 2,000 ft.

Elsewhere noted at: Singarenni Collieries, Nelipāka, Deglūr.

Iris brown; bill horny-grey, blacker on culmen and tip of lower mandible; mouth pale yellowish-pink or greyish-pink; legs and feet brownish flesh-colour; claws brown.

Winter visitor. The Grey Wagtail was usually met with singly near streams or rocky pools in forest, never away from water. It was nowhere abundant. The earliest and latest dates of meeting are supported by specimens.

A long note on the migrations of this bird by Mr. Whistler which summarizes the literature on the point, will be found in J.B.N.H.S., xxix, 287.

The organs of all the specimens were in a quiescent state. Both Nos. 624 (1 April) and 700 (16 April) were very fat and presumably preparing to emigrate.

Motacilla flava beema (Sykes). The Indian Blue-headed Wagtail.

Budytes beema Sykes, P.Z.S., 1832 (July 31), p. 90—Dukhun.

Specimen collected: 501 ♂ 3-3-32 Kandahār 1,400 ft. Other specimens from Trimulgherry in the Sparrow Collection are as follows: ♂ 16-3-11, ♂♂ 21-3-11, ♂ 26-3-11.

Iris brown; bill horny-brown, paler at base of lower mandible; gape dull lemon-yellow; mouth yellowish-pink; legs, feet and claws horny-black.

The specimen was shot on the grass-covered marshy margin of the village tank where this wagtail appeared to be common. Owing, however, to the difficulty of identifying, with certainty, the different members of this group in their various plumages in the field, I refrain from giving sight records. It is probably a fairly common species in winter in the Deccan.

The testes of the specimen showed no departure from the normal non-breeding condition.

Motacilla flava thunbergi Billberg. The Grey-headed Wagtail.

Motacilla thunbergi Billberg, Synops. Fauna Scand. pt. ii (1828), p. 50—Lapland.

Not obtained by the Survey.

[Two males, not however in full plumage, in the Sparrow Collection collected at Trimulgherry on 5-11-12 and 10-11-10 appear to belong to this form. One would expect it to occur in Hyderābād as it is found in Travancore and Ceylon, though it is possible that the Ceylon winter visitors arrive via the Andamans.—H.W.]

Davidson and Wenden (S.F., vii, 84) considered it a common winter visitor to the Deccan and observed it at Poona as late as the end of March. Butler

(S.F., ix, 410) collected specimens (now in the British Museum) at Belgaum in September and records it as common there.

Motacilla feldegg melanogriseus Homeyer. The Black-headed Wagtail.

Budytes melanogriseus Homeyer, Jour. für Orn., 1878, p. 128—India.

Specimen collected: 534 ♀ 12-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Nīrmal.

Iris brown; bill horny-brown, paler at base of lower mandible; gape dull lemon-yellow; mouth yellowish-pink; legs, feet and claws horny-black.

The specimen was procured in the neighbourhood of flooded paddy-fields close to the town, where the birds were fairly abundant. Its ovaries were undeveloped but it was excessively fat and apparently preparing to emigrate.

On 12 April these Wagtails were still present, several being observed about the tank at Nīrmal in full breeding plumage.

Motacilla citreola weræ Buturlin. The Yellow-headed Wagtail.

Motacilla citreola weræ Buturlin, Orn. Monatsb., 1909, p. 197—Simbirisk, S.-E. Russia.

Specimens collected: 532 ? 9-3-32 Mūkhēr 1,350 ft.; 533 ♀ 12-3-32, 552 ♂ 15-3-32 Deglūr 1,300 ft. Other specimens from Hyderābād in the Sparrow Collection as follows: ♂ 6-11-12, ♂ 8-11-12, ♂ 7-11-12, ♂ 16-3-11, ♀ ?-3-11 Trimulgherry.

The British Museum Collection has ♂ 20-3-75 Ahmadnagar (Fairbank); ♂ 16-2-70 S.-E. Berār (Blanford).

Iris brown; bill horny-brown, paler at base of lower mandible; gape dull lemon-yellow; mouth yellowish-pink; legs, feet and claws horny-black.

Winter visitor. All the Survey specimens were shot near water. At Deglūr these wagtails were very partial to the flooded paddy-fields on the outskirts of the town, where numbers could always be seen in company with *M. f. melanogriseus* and other species.

The specimens were all undergoing body moult into the yellow-headed breeding plumage, the rectrices and tectrices being fresh. The last 2 examples, moreover, were very fat and it was clear that the birds were preparing to leave shortly for their northern breeding grounds. Their gonads as yet were undeveloped.

Dendronanthus indicus (Gmelin). The Forest Wagtail.

Motacilla indica Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 962—India.

On 12 October (1931) a pair was noted in a small grassy clearing in forest at Manānūr, and a single bird was observed flying over the Forest Bungalow at Farāhābād (2,800 ft.) on 17 October. When alarmed, the birds flew up into the nearest tree like Pipits, and both while perched and on the wing uttered a *pink-pink* reminiscent of the Crested Bunting (*Melophus lathami*).

I did not come across this wagtail elsewhere within the State.

[Recorded by Blanford from the Godāvari Valley (Ball, S.F., vii, 219) (Original record not found). I have traced no other record at all between the sub-Himalayan tracts, where it is evidently a casual straggler, and the Western Coast where it is recorded in numerous localities from Mahābleshwar to Travancore. It was not obtained by the Eastern Ghāts Survey at all, and on the eastern side I only know of it at Nellore (Jerdon, B. of I., ii, 227) and Madras ('Seen twice by me'), Dewar, J.B.N.H.S., xvi, 490.—H.W.]

Anthus trivialis trivialis (Linn.). The Tree-Pipit.

Alauda trivialis Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 166—Sweden.

Specimens collected: 504 ♂, 505 ♀ 3-3-32 Kandahār 1,400 ft.

Iris brown; bill, upper mandible and tip of lower mandible horny-brown, rest of lower mandible flesh-colour; mouth pale pink; legs and feet brownish flesh-colour.

Other specimens from Hyderabad State in the Sparrow Collection are as follows: ♀ 28-1-12, ♀ 2-11-12 Trimulgherry; o? 20-12-10 Medchal; ♂ 23-1-11 Jālna.

The Survey specimens were secured out of several birds feeding together in a scattered flock on moist grassy land bordering the tank. They were also observed in stubble fields and on the ground under mango topes.

On account of the possible confusion with other species and races, I omit sight records as they can obviously be of little value.

No. 504 (3 March) had apparently completed a general moult; it was in fresh plumage and very fat. No. 505 was just completing its moult into fresh plumage. I conclude from these particulars that the birds were getting ready for the outward migration.

Anthus trivialis haringtoni Witherby. Harington's Tree Pipit.

Anthus trivialis haringtoni Witherby, Bull. B.O.C., vol. xxxvii (1917), p. 43—Khagan Valley.

Specimens collected: 487 ♀ 1-3-32 Kandahār 1,400 ft.; 564 ♀ 16-3-32 Deglūr 1,300 ft.; 622 ♀ 1-4-32 Utnoor 1,250 ft.; 734 ♀ 22-4-32 Bhāmarvādi 2,500 ft.

Iris brown; bill, upper mandible and tip of lower mandible horny-brown; rest of lower mandible flesh colour; mouth pale pink; legs and feet brownish flesh colour.

Met with singly and in parties of 4-10 birds in chilli fields, fallow land and light deciduous jungle at the edge of forest.

No. 487 (1 March) was in general moult—body, wings and tail. No. 564 was undergoing heavy body moult only, having the rectrices and tectrices fresh, while both Nos. 622 (1 April) and 734 (22 April) were in freshly moulted plumage. Nos. 564 and 622 were very fat.

[The new *Fauna*, vol. iii, p. 281, informs us that Harington's Tree Pipit is a very sedentary form and very seldom wanders into the lower hills of N.-W. India. This statement has always seemed to me very questionable as I never met with it in winter in any of the lower and middle ranges of the North-West Himalayas, and it could hardly be expected to live in winter on the high hills where it breeds. The discovery of the winter quarters at last is therefore of the highest interest.

In good plumage *haringtoni* differs from the typical race in the more earthy less olive-fulvous brown of the upper parts, the paler fulvous of the breast and flanks, the slightly heavier streaking of the breast and the broader deeper bill. In worn breeding plumage the only recognisable difference is that of the bill.—H.W.]

Anthus campestris thermophilus (Jerdon). Blyth's Pipit.

Corydalla thermophilus Jerdon (ex Hodgson), Birds of India, vol. ii (1863), p. 233—Nepal.

Specimens collected: 207 ♀ (imm) 1-11-31 Borgampād 160 ft.; 261 ? 8-11-31 Nelipāka 160 ft. Col. Sparrow's collection contains the following: ♂♂ 27-10-10 Trimulgherry.

In the British Museum Collection there are the following specimens from the Deccan: ♀ ?-2-70 S.-E. Berār (Blanford), o? -10-74 Shah Dongar, Ahmadnagar (Fairbank).

Iris brown; bill flesh colour, dusky on upper mandible and tip of lower mandible; legs and feet pale yellow; gape and mouth bright yellow.

[This form is now believed to be a race of *campestris* and not *richardi* as apparently it breeds in part in the same areas as *richardi*. The correct name for *striolatus*=*godlewskii* is *thermophilus*, vide C. B. Ticehurst, J.B.N.H.S., xxxii, 352—H.W.]

Met with singly or in pairs or small parties in stubble fields, grass and fallow land &c. or on the edge of cultivation.

No. 207 (1 November) was a young bird of the year with imperfectly ossified skull.

Anthus campestris griseus. Nicoll. The Eastern Tawny Pipit.

Anthus campestris griseus Nicoll, Bull. B.O.C., vol. xli (9 November 1920), p. 25—Turkestan.

Specimens collected: 75 ♂ (imm) 10-10-31 Manānūr 2,000 ft.; 556 ? 15-3-32 Deglūr 1,300 ft.

Iris dark brown; bill pinkish flesh-colour, dusky on culmen; legs and feet brownish flesh-colour; claws dusky.

Met with singly or in pairs or small parties in open country—cultivation, fallow land etc.

No. 75 (10 October) was immature with imperfectly ossified skull.

Blanford mentions it from the Wardha Valley (J.A.S.B., 1871) while Fairbank considered it a common bird in the Deccan (S.F., iv, 260).

Anthus rufulus rufulus Vieillot. The Indian Pipit.

Anthus rufulus Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. xxxvi (1818), p. 494—Bengal.

Specimens collected: 193 ♂ 30-10-31, 220 ♀ (imm) 2-11-31 Borgampād 160 ft.; 262 ♂ 8-11-31 Nelipāka 160 ft.; 354 ♂ (imm) 21-11-31 Pāloncha 300 ft.; 399 ♂ 1-12-31 Narsampēt 800 ft.; 625 ♂ 1-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Kandahār, Kaulās, Kāmāreddi, Nīrmal, Aurangābād.

Iris brown; bill, upper mandible and tip of lower mandible horny-brown, rest of lower mandible pale flesh-colour; gape yellow; mouth bright yellow in immature, yellowish-pink in adult; legs and feet pale yellow or brownish flesh-colour; claws dusky.

Like the other pipits, this species frequents open grassland, fallow or newly ploughed fields and the edge of cultivation, in pairs or small scattered flocks. It is common and generally widespread in the Peninsula and a resident everywhere.

[No. 220 is much paler than the others and I do not feel quite sure whether it is an unusually small specimen of *A. campestris griseus* or a winter migrant of the pale form of *rufulus* in the N.-W. which I am naming in the Eastern Ghats Survey Report.

I can find no point by which to decide whether *rufulus* and other races should be regarded as races of *richardi* or whether there should be a separate species *rufulus* with its own races.—H.W.]

Breeding: Specimens No. 220 (2 November) and 354 (21 November) were young birds of the year with imperfectly ossified skulls. In No. 399 (1 December) the testes still showed no signs of development, but from about the third week of March up to the time the Survey was in the field the birds were mostly observed in pairs and they were breeding. On 28 March (Bāsar) a bird was noted carrying food to nest on dry fallow land covered with short grass and deep hoof-prints of cattle. No. 625 (1 April) had the testes enlarged to 10×6 mm. and it had a prominent incubation patch on the abdomen. It was one of a pair on the dry grassy edge of a tank from whose behaviour it was obvious that they were breeding. The nest itself, however, was not located.

At this season the males were constantly rising in the air, soaring a few feet and singing a feeble little song, somewhat like, but much inferior to and shorter than that of the Skylark (*Alauda*).

FAMILY: ALAUDIDÆ.

Calandrella brachydactyla dukhunensis Sykes. The Rufous Short-tailed Lark.

Alauda dukhunensis Sykes, P.Z.S., 1832 (July 31), p. 93—Dukhun.

Specimen collected: 537 ♀ (imm) 12-3-32 Deglūr 1,300 ft.

Not noted elsewhere.

Iris brown; bill greyish flesh colour, dusky on culmen; gape cream colour; mouth pale pink; legs and feet brownish flesh colour.

[Three specimens obtained by the Eastern Ghats Survey in the Godavery Delta (19-26 January) and three specimens collected by Butler at Belgaum (26-28 February, Hume Collection) provide the most southerly records of this race but Davison (J.B.N.H.S., xi, 674) considered (probably correctly) that two or three flocks of Short-toed Larks seen by him in North Kanara belonged to this race.—H.W.]

A flock of over a hundred birds kept to broken sparsely-shrubbed country near cultivation on the outskirts of the town, and was observed on three successive days coming to the river to drink at one particular spot near the Pātalganga Gorge at about 8 a.m. I have also noted before this habit of coming to drink in the morning at favourite tanks in the Kolāba District between the months of November and January.

The specimen was a young bird with imperfectly ossified skull.

Mirafra javanica cantillans Blyth. The Singing Bush-Lark.

Mirafra cantillans Blyth, J.A.S.B., vol. xiii (after December 1844), p. 960—Bengal.

Specimen collected: 536 ♂ 12-3-32 Deglūr 1,300 ft.

Iris hazel brown; bill horny-brown on culmen, pale flesh colour on lower mandible and commissure; mouth bright lemon yellow; legs and feet pale flesh colour.

The above was a single bird perched on the dry grassy bund of a paddy-field. A specimen in the Sparrow Collection is labelled as follows: ♀ 5-8-12 Trimulgherry. According to the collector it is a common resident species in this locality.

[Throughout its range this Bush-Lark seems to have one unfailing characteristic that it is extremely local being common in one small patch of country and then absent for miles—no doubt some ecological significance in this. Indian birds are best treated as a race of *javanica*.—H.W.].

Breeding: The testes of the specimen measured about 2×1 mm. and appeared to be developing.

Captain Bates found 2 nests at Secunderābād (no details—J.B.N.H.S., xxxi, 287), while at Trimulgherry Colonel Sparrow has taken eggs between 9 April and 18 May. He considers April to be the best month for them. As, however, there is no mention of *Mirafra affinis* at all in his MS. notes, the above records must be accepted with caution.

Mirafra affinis Blyth. The Madras Bush-Lark.

Mirafra affinis Blyth, J.A.S.B., vol. xiii (after December 1944—Goomsur in Ganjam.

Specimens collected: 11 ♂ 12 ♂ 27-9-31 Hyderābād City Environs (Ūmdā Sāgar Tank) 1,800 ft.; 29 ♂ 5-10-31, 109 ♂ 12-10-31 Manānūr 2,000 ft.; 251 ? 5-11-31 Borgampād 160 ft.; 284 ♀ 10-11-31 Nelipāka 160 ft.; 404 ♀ 2-12-31 Narsampet 800 ft. Also examined: ♂ 3-3-12 Trimulgherry (Sparrow Coll.)

Iris hazel brown; bill horny-brown on culmen, pale flesh on lower mandible and commissure; mouth pale pink; legs and feet pale flesh colour; claws duskier.

[This is certainly not a race of *assamica* as I shall explain in the E. Ghats Survey Report. It must either be treated as a separate species or as a race of *Mirafra erythroptera*. The differences in plumage between these two forms are only such as are ordinarily of subspecific value whilst their ranges are largely complementary.—H.W.].

Both *affinis* and *erythroptera* were undoubtedly obtained by the Survey in the southern and eastern portions of Hyderābād State (see localities of specimens), though it is clear on the whole that the former is the more eastern and southern form, while the latter is the northern and western.

Further observation is necessary to determine whether in areas where their occurrence coincides, both forms occupy different terrain or whether the occasional overlapping is due to seasonal wandering.

Mirafra larks are commonly and abundantly distributed all over the Dominions. They are usually met with singly or in pairs in open scrub country, stony grassland, castor fields, on footpaths and small clearings in tall grass, and sometimes even in secondary forest.

The male utters a squeaky *weet-weet* like the Purple Sunbird (*Leptocoma asiatica*) as it rises 30 or 40 feet in the air to soar and sing, and parachutes in spirals or zigzags on motionless outstretched wings and dangling legs to perch on a stone or bush, or even quite high up in a tree. The song is rather a feeble piping *chee-wichee, chee-wichee, chee-wichee* &c. It also frequently sings from its perch on bush- and tree-tops. Besides the song, it has a mousy, quick-repeated *chip-chip-chip-chip* which is uttered from a perch, the sound being something between the low *cheeps* of the Small Minivet (*Pericrocotus peregrinus*) and the notes of the Flowerpecker (*Dicæum erythrorhynchum*).

When alarmed the birds often fly up into the nearest tree like Pipits, shooting up into the branches without wing-beats after the first flutter.

I found these birds most often in laterite and moorum country where the colour of their wings matched the soil to perfection.

In both Nos. 11 and 12 (27 Sept.) the testes measured 3×2 mm. and were apparently reverting to non-breeding condition. In the rest of the specimens the gonads were minute.

Mirafra erythroptera erythroptera Blyth. The Red-winged Bush-Lark.

Mirafra erythroptera Blyth, J.A.S.B., vol. xiii (after December 1844), p. 958—N. Indian Peninsula=Northern Deccan.

Specimens collected: 13 ♂ (imm?), 14 ♂ (imm?) 27-9-31 Hyderābād City Environs (Ūmdā Sāgar Tank) 1,800 ft.; 464 ♂ 13-12-31 Āsifābād 1,200 ft.; 511 ♂ 5-3-32 Kandahār 1,400 ft.; 521 ♂ 8-3-32, 522 ♀ Mūkhēr 1,350 ft.; 709 ♂ 18-4-32 Kannad 2,000 ft.; 725 ♂ 20-4-32 Bhāmarvādi 2,500 ft..

Other specimens from Hyderābād and neighbouring areas seen by Mr. Whistler as follows: ♂ 21-1-70, o? 2-70 S.-E. Berār (Blanford—B.M. Coll.); ♂ 11-11-10, ♂ 12-3-11 Trimulgherry (Sparrow Coll.); ♀ 4-7-07, ♂ 18-7-07 Aurangābād (H. R. Baker Coll.).

Soft parts same as in *M. affinis.*

The habits and habitat of all the three foregoing species of Mirafra larks are more or less identical, and it is difficult to differentiate the birds in the field.

Breeding: Specimens No. 13 and 14 (27 September) were undergoing post-nuptial moult (body and wings) while their testes which measured 3×2 mm. appeared to be reverting to normal non-breeding condition. Strangely enough their skulls were imperfectly ossified. The testes of No. 511 (5 March) and those of 709 (18 April) were enlarging. In the former they measured 6×3 mm. and in the latter 4×3. The rest of the specimens showed no gonadal development.

Col. Sparrow, who found this a common resident species at Trimulgherry, took nests between 13 March and 9 June, principally during April and May. Jerdon (B. of I., ii, 419) records it as very common about Jālna in low jungle, while between Poona and Rāichūr, Davidson and Wenden (S.F., vii, 85) mention it also as very common, dozens being seen all along the railway line, many perching on the telegraph wires.

Galerida deva (Sykes). Sykes' Crested Lark.

Alauda deva Sykes, P.Z.S., 1832 (July 31), p. 92—Dukhun.

Specimens collected: 8 ♀ 25-9-31 Hyderābād City Environs (Mīr Ālam Tank) 1,800 ft.; 500 ♂ 2-3-32, 502 ♂, 503 ♂ (imm.) 3-3-32 Kandahār 1,400 ft.; 530 ♂, 531 ♀ 9-3-32 Mūkhēr 1,350 ft.; 561 ♀ 562 ♀ 16-3-32 Deglūr 1,300 ft.

Other specimens examined by Mr. Whistler: ♂ 18-7-12, ♀ 27-10-10 Trimulgherry (Sparrow Coll.); ♂ 16-9-06, ♂ 4-7-07, ♀♀ 18-4-07, ♀ 30-10-06 Aurangābād (H. R. Baker's Coll.); [♂] 10-8-18 Bolārum (A. J. Currie); ♀ ♂ 30-6-74 (with eggs), ♀ 13-7-74 Sholāpur (Hume Coll. in B.M.).

Iris hazel brown; bill pale flesh colour, horny-brown on culmen; mouth pinkish-yellow; legs and feet brownish flesh colour. In No. 561, gape yellowish cream colour.

These larks were found frequenting bare stony, broken country with straggly grass and sparse stunted bushes. They were met with either in pairs or small flocks which flew about in disorderly fashion.

Breeding: No. 8 (25 September) was breeding. The ovary contained 'soft eggs', the largest of which measured 9 mm. in diameter. 503 (3 March) was a young bird with the skull as yet imperfectly ossified in the centre. The gonads of the other specimens showed no departure from the normal non-breeding condition.

Col. Sparrow found this species breeding in the neighbourhood of Trimulgherry between 12 March and 25 September, chiefly during July and August when he took most eggs. At Sholāpūr it breeds from July to September (Davidson, J.B.N.H.S., v, 325) and in the Bhīma Valley (Davidson and Wenden, S.F., vii, 86) in July and August.

Jerdon observed Sykes' Crested Lark at Jālna (B. of I., ii, 432).

Alauda gulgula australis Brookes. The Indian Skylark.

Alauda australis Brookes, S.F., vol. i (1873), p. 486—Ootacamund.

Specimen collected: 547 ♂ 14-3-32 Deglūr 1,300 ft.

Another examined by Mr. Whistler in the B.M. Coll.: ♂ 5-3-70 S.E. Chānda (Blanford.).

Iris hazel brown; bill horny-brown on culmen and tip of lower mandible, pale brownish flesh colour on rest; mouth orange-pink; legs and feet brownish flesh colour.

One of a pair on moist grassland with sparse bushes &c. on the margin of a tank near the town. Apparently breeding or about to. The testes of the specimen measured 6×5 mm. and he was continually soaring and hovering, and singing for well over 5 minutes at a time.

Another pair observed in similar facies, also with the male soaring and singing, at Nīrmal on 12 April was also very probably this species.

[An interesting record. Single specimens of Skylarks are notoriously difficult to identify and a series is really necessary to eliminate the possibility of error, but the above bird seems to agree with Nilgiri specimens.—H.W.]

At Satāra where it is not uncommon, Davidson took what he supposed was a nest of this species in May. (Davidson and Wenden, S.F., vii, 86).

Ammomanes phœnicura phœnicura (Franklin). The Rufous-tailed Finch-Lark.

Mirafra phœnicura Franklin, P.Z.S., 1830-1831 (25 October 1831), p. 119—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mandela.

Specimens collected: 212 ♂, 213 ♂ 1-11-31 Borgampād 160 ft.; 270 ♂ 9-11-31 Nelipāka 160 ft.; 462 ♀ 13-12-31, 478 ♂ 16-12-31 Āsifābād 1,200 ft.; 609 ♂, 610 ♀ 24-3-32 Kaulās 1,400 ft.

Elsewhere noted at: Hyderābād City Environs, along Jedcherla-Achampet Road (Mahbūbnagar Dist..), Singarenni Collieries, Kandahār, Bāsar, Nīrmal, Utnoor, Aurangābād, Kannad.

Iris hazel brown; bill horny-brown, darker on upper mandible and tips; mouth dull orange, orange-pink or flesh colour varying presumably with age; legs and feet brown; claws darker.

The Rufous-tailed Finch-Lark is a very common resident species over the entire State as it is throughout the Deccan. It frequents ploughed fields, fallow land and the neighbourhood of cultivation, being usually met with in small parties which break up into pairs with the advent of the breeding season. It has a pleasant song which is not infrequently uttered even while the bird is perched on a clod or stone on the bund of a field. While moving along the ground to feed—which it does in short runs—I have often noticed it flicking open its wings. I believe this is a manoeuvre to dislodge little insects from their hiding places in the various nooks and crannies or under the grass etc. This method, as I have remarked elsewhere, is also employed by many different species of birds. Their food chiefly consists of grass seeds, but insects are also taken. Though not shy ordinarily, they become extremely wary and circumspect in the breeding season, so that it is by no means easy to mark down their nests by their movements.

Breeding: 609 and 610 (a pair—24 March) were breeding. The testes of the male measured 6×5 mm. while the female had a number of 'soft eggs' the largest measuring 10 mm. in diameter. Both the birds were in fresh plumage and the female had a prominent incubation patch on the abdomen.

On 29 March a pair were observed (both birds) carrying grass blades in fallow land with boulders and sparse scrub at Bāsar, while on the same day another bird was noted carrying an insect in its bill for the young. The birds at Aurangābād and Kannad were also obviously breeding.

The gonads of the specimens prior to 24 March were in an undeveloped condition.

Col. Sparrow found nests of this species between 28 February and 18 April.

In the neighbourhood of Poona, where it is common, the breeding season is April and May (Betham, J.B.N.H.S., xiii, 687). In the Sholāpur District also it nests at the same season (Davidson and Wenden, S.F., vii, 85) while at Nāsik, according to Davidson (J.B.N.H.S., v, 322) February and March appear to be the most favoured months.

Eremopterix grisea grisea (Scopoli). The Ashy-crowned Finch-Lark.

Alauda grisea Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 94—Gingee.

Specimens collected: 65 ♂ 8-10-31 Manānūr 2,000 ft.; 362 ♂ 23-11-31, 383 ♀ 27-11-31 Pāloncha 300 ft.; 555 ♀ 15-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Hyderābād City Environs, Jedcherla-Achampet Road (Mahbūbnagar District), Singarenni Collieries, Borgampād, Nelipāka, Kandahār, Nīrmal, Aurangābād, Kannad.

Iris ♂ reddish-brown (Indian red), ♀ yellowish-brown; bill pale horny-grey, duskier on culmen; mouth pale pinkish with admixture of yellow in young birds; legs, feet and claws brownish flesh colour.

This Lark is even commoner everywhere in the Dominions than the foregoing. It inhabits similar terrain and is, besides, particularly fond of squatting on and feeding along roads. It is a familiar sight to see the birds—pairs or small parties—rise up suddenly when a car is almost upon them with rapid ('hovering') wing beats followed by short spells of sailing, often one bird chasing another, turning and twisting close to the ground. After a hundred yards or so both birds mount almost perpendicularly up in the air and sweep round to about the same spot whence they rose and settle down on the road once more. The males have a very pleasant and powerful little song which they sing while soaring and hovering. While singing they also indulge in a variety of aerobatics especially in the breeding season, shooting perpendicularly to earth when the song is over.

Breeding: The season is apparently much prolonged. Nos. 65 (8 October) and 362 (23 November) both had testes measuring about 6×4 mm. suggesting that they were breeding, while between 1 March and the end of April the breeding was certainly in full swing. No. 555 (15 March) had the follicles enlarged, the largest measuring about 2 mm. and it had an incubation patch on the abdomen. A female carrying *Bombax* down in her bill was followed up on the same day to a nest under a projecting stone in open stony country. The following nests were further located:—

Kaulās: 26 March. (1) At base of diminutive *Acacia* bush. 2 eggs.
(2) In similar situation about 100 yards distant. 2 eggs.
(3) At base of small thistle-like plant (*Argemone mexicana*) on open shingly ground near stream. 2 eggs.
(All the above were within a radius of 300 yards.)
Kannad: 16 April. (4) In freshly ploughed field under shelter of a clod (on eastern side). 2 eggs.

The nests are tiny circular depressions lined with grasses sometimes bordered with small stones etc. and 2 seems to be the usual number of eggs laid.

On 14 April (Aurangābād) a male was observed carrying food to young on the open stony country surrounding 'Bibi-ka-Maqbera'.

While trying to photograph the nests of these Larks, I discovered that the female was always the more fearless of the pair when on or approaching the nest with an observer nearby. Both parents share in incubation and care of the young.

In the Bhīma Valley, Davidson and Wenden (S.F., vii, 85) were of the opinion that it breeds at all seasons, while in the neighbourhood of Trimulgherry Col. Sparrow found nests between 19 October and 29 April. He considers November and April the best months for eggs.

[Captain Bates has given me a detailed account of nests at Madras, where he found 4 nests within 130 yards, 2 of the nests being only 4 paces apart. It is clear that in this species there is no question of 'territory' and I think that in most species the value and existence of 'territory' has been much exaggerated. It is probably the exception and not the rule we are led to expect.—H.W.]

FAMILY: ZOSTEROPIDÆ.

Zosterops palpebrosa salimalii Whistler. The White-eye.

Zosterops palpebrosa alii Whistler, J.B.N.H.S. Vol. xxxvi, p. 811.

Specimens collected: 73 ♀ 9-10-31, 104 ♀ 12-10-31 Manānūr 2,000′; 166 ♀ 18-10-31 Farāhābād 2,800′; 567 ♂ 18-3-32 Kaulās 1,350.

Elsewhere noted at: Pāloncha, Āsifābād, Deglūr, Utnoor, Kannad, Bhāmarvādi, Iris hazel brown; bill brownish-slate, paler (bluish-grey) on lower mandible; legs and feet bluish-grey; claws dusky; mouth pink or yellowish-pink.

The White-eye is common in the better wooded portions of the State. In the eastern districts it appears to be chiefly confined to the hills. It moves about in flocks usually of 8-10 birds who keep up a mewing 'cheeping', unmistakable when once heard. It frequents scrub and secondary jungle, hunting among the foliage for insects. It is partial to Peepal figs (*Ficus religiosa*) on which it was frequently observed feeding in company with other birds. Flocks were also regularly noted on Mhowa trees in blossom, probing into the flowers and eating the fleshy portions. I also saw it commonly probing into *Loranthus* flowers for nectar and have no doubt that it is to some extent responsible for their cross-pollination.

Fairbank (S.F., iv, 269) records the White-eye as common everywhere in the Deccan and Sahyadris, and Davidson and Wenden (S.F., vii, 84) describe it as not rare in the Satara District.

Breeding: The testes of No. 567 (18 March) showed signs of enlarging. They measured ca 3×2 mm. The organs of the other specimens, collected in October, were in a quiescent state.

At Poona, ca 2,000/ where, according to Betham, it is common, it breeds from April to September (Barnes, *J.B.N.H.S.*, v, 97-99). E. Aitken took a clutch of 3 eggs in this locality on 21 July (N. & E. i, 144).

FAMILY: NECTARINIDÆ.

Cinnyris asiatica asiatica (Latham). The Purple Sunbird.

Certhia asiatica Latham, Index Orn. vol. i (1790) p. 288—India.

Specimens collected: 365 ♂ 24-11-31 Pāloncha 300′; 424 ♂ 5-12-31 Narsampēt 800′.

Elsewhere noted at: Hyderābād City and environs, Manānūr, Farāhābād, Kaulās, Borgampād, Nekonda, Āsifābād, Kandahār, Utnoor, Aurangābād and Bhāmarvādi.

Other specimens from Hyderābād State and neighbouring areas examined by Mr. Whistler as follows: Several in the Sparrow Collection dated March to December from Trimulgherry, and in the Baker Collection dated December and April from Aurangābād. A series from Ahmadnagar (Fairbank) in the British Museum dated January, April, September, October, November and December. Also ♀ 21-2-71 Bhadrāchalam (Blanford) B. M. Coll.

Iris brown; bill brownish-black; mouth pinkish-yellow; legs, feet and claws brownish-black.

The Purple Sunbird is a common and familiar resident species throughout the Dominions, frequenting gardens, groves, scrub country and light forest. Its food consists to a large extent of the nectar of flowers into which it may invariably be seen probing with its bill. It plays a more important part than is generally suspected in the cross-pollination of many species. The following are some of the species whose blossoms I observed to be visited by this Sunbird and its Purple-rumped congener in the Hyderābād State. An asterisk behind the name indicates where microscopic examination showed pollen adhering to forehead, chin or bill:

Russelia juncea Zucc.) Both exotic garden plants.
Holmskioldia sanguinea
Vitex negundo
Moringa oleifera
Æschynomene coccinea
Millingtonia hortensis (mostly 'short-cuts').
*Erythrina indica**
*Erythrina suberosa**
Bauhinia pupurea
Opuntia sp. (Cobra Cactus)
Butea superba
*B. frondosa**
Woodfordia fruticosa
Goniocaulon glabrum Cass.

Loranthus longiflorus Desr.*
*Grewia flavescens**
Carica papaiya
*Bombax malabaricum**

Also the papilionaceous flowers of a species of Vetch.

Both this species and the next were moreover frequently observed sipping the sap exuding from *Borassus* palms tapped for toddy. They are likewise fond of the fleshy flowers of the Mhowa (*Bassia latifolia*).

Breeding: The organs of the Survey specimens were in an undeveloped condition. On 18 March (Kaulās) a nest was found in a Babool bush at about 3′ from the ground, containing 2 eggs and another on the tip of a thorn branch forming a guard round a newly planted roadside tree, also at about 3′, was nearing completion. On 24 March (Kaulās) a third nest was discovered hung in a thorn bush over a dry nullah at about the same height, containing 2 eggs. On 1 April (Utnoor) a nest was being built in a thorn bush at about 4′, in scrub country. On 14th April (Aurangābād) a female was observed gathering cobwebs near the 'Bībī-kā-Maqbera'. On 22 April (Bhāmarvādi) two full-fledged young were observed in the company of their parents.

Only the female builds, but the cock is generally in attendance. The brooding is also done exclusively by the hen.

March and April seem to be the months when breeding is at its height.

At Akola (Berar) Benjamin Aitken took a clutch of 2 eggs as early as 19th January (N. and E., ii, 256).

Cinnyris zeylonica (Linnæus). The Purple-rumped Sunbird.

Certhia zeylonica Linnæus, Syst. Nat. ed. xii, vol. i (1766) p. 181—Ceylon.

Specimens collected: 38 ♂ 6-10-31 Manānūr 2,000′; 305 ♂ 14-11-31 Nelipāka 160′; 425 ♂, 426 ♂, 427 ♂ (imm) 5-12-31 Narsampēt 800′.

Elsewhere noted at: Hyderābād City and Environs, Borgampād, Pāloncha, Kandahār, Kaulās, Utnoor (15-10-25).

Iris orange-brown or reddish-brown; bill brownish-black; mouth dull orange-pink or pinkish-brown; legs, feet and claws horny brown or black; soles yellowish flesh colour.

Other specimens from Hyderābād and neighbouring areas examined: ♀ (juv.) 18-11-10. ♂ 4-12-10, (♀) 24-2-11, Trimulgherry (Sparrow Coll.); ♀-2-70, ♂ 21-1-70 S. E. Berar (Blanford), ♂-2-73 near Bhadrāchalam (Blanford) B.M. Collection.

This Sunbird appears to be much less generally distributed in the State than the foregoing. It was noted as absent at Farāhābād, Āsifābād, Kannad and Bhāmarvādi, while at Borgampād, Kandahār and Kaulās it was far less common than the Purple species. I also failed to meet with it at Utnoor though my diary for 1925 records it thence.

According to Fairbank, Barnes, Davidson and Wenden and other observers it is common everywhere in the Deccan and Southern Mahratta country. It was not observed by Fairbank at Khandala or Mahābleshwar (S.F., iv, 256) however, and Barnes (J.B.N.H.S., iv, 84) states that in the Nasik District Davidson never noticed it further east than Nasik itself and that similarly in Sholapur it did not come further east than Pandharpūr!

Breeding: Nos. 38 (6 October) and 305 (14 November) both had testes enlarged to ca 5×3 mm. and they appeared to be breeding. In Nos. 425 and 426 (5 December) they had reverted to non-breeding condition, while No. 427 was a young bird of the season with imperfectly ossified skull.

I have a record of a nest in a garden at Saifābād (Hyderābād City) on 8 October 1925 which contained 1 egg and 1 naked chick. The next morning the second chick had also hatched out. In the Konkan I found the breeding season to be between July and October, the period of incubation being 14/15 days. The female alone builds the nest and incubates the eggs, but the male assists in feeding the young.

At Poona, Benjamin Aitken found a nest with eggs hatching on 25 March 1871 (N. and E., ii, 266) while at Madras Dewar records numbers of nests in the same month.

FAMILY: DICÆIDÆ.

Dicæum erythrynchos erythrynchos (Latham) Tickell's Flowerpecker.

Certhia erythrorhynchos Latham, Index Orn., vol. i (1790) p. 299—India.

Specimens collected: 42 ♀ 6-10-31, 77 ♀ 10-10-31 Manānūr 2,000′; 586 ♂ 21-2-32 Kaulās 1,350′.

Elsewhere noted at: Hyderābād City and Environs, Farāhābad, Pāloncha, Utnoor ('Not common'), Kannad.

There is a specimen, ♀ 15-3-13 from Eswantaräopēt in the Sparrow Collection.

I found the distribution of Tickell's Flowerpecker in the Hyderābād State to be dependent entirely upon the presence or absence of the *Loranthus* tree parasite, on the berries of which it largely feeds and for which it acts as practically the exclusive seed disseminator. Wherever I failed to meet *Loranthus*, there also was noted a corresponding absence of this species: such was the case at Borgampād, Narsampēt, Āsifābād and Kandahār. Besides dispersing the seed, this Flowerpecker also assists in some measure in the fertilisation of the *Loranthus* blossoms by springing open the mature buds and probing into the flower tubes for nectar. In the course of this operation it transports the ripe pollen, adhering to its forehead feathers, to the stigma of other flowers. Elsewhere[1] I have described in detail the rôle of Sunbirds and Flowerpeckers in the propagation of *Loranthus longiflorus* Desr., and my observations in Hyderābād tend fully to support my former conclusions.

Berries of *Viscum* spp. and of *Phyllanthus reticulatus* are also eaten, as also is the fleshy portion of Mhowa flowers. The guts of No. 586 contained one *Loranthus* and two *Viscum* seeds.

Breeding: On 21 February (Saifābād) a full-fledged young except for the tail (which was as yet stumpy), and just able to fly with difficulty, was observed being fed by its parents apparently on the pulp of *Loranthus* berries. The mouth of the young bird was bright orange in colour.

No. 586 (21 March) had the testes enlarged to ca 4×3 mm. The ovaries of both the other specimens (6 and 10 October) were undeveloped.

Records of Davidson, Barnes, and Butler show that the breeding season in the neighbouring Deccan areas and in the Southern Maharatta country extends from February to May.

Piprisoma agile agile Tickell. The Thick-billed Flowerpecker.

Fringilla agilis Tickell, J.A.S.B., vol. ii (Nov. 1833) p. 578—Borabhum and Dholbhum.

Specimens collected: 167 ♂, 168 ♂ 18-10-31, Farāhābād 2,800′; 298 ♀ 13-11-31 Nelipāka 160′.

Elsewhere noted at: Manānūr, Pāloncha, Narsampēt, Pākhāl Lake, Āsifābād, Kaulās, Utnoor, Kannad and Bhāmarvādi.

Iris orange-brown; bill horny grey, duskier on upper mandible; legs and feet dark slate colour; claws dusky; mouth bright yellow and pink.

The Thick-billed Flowerpecker is fairly common in orchards and well-wooded country throughout the State, though not really abundant anywhere. This species also feeds largely on *Loranthus* and *Viscum* berries but is by no means so dependent on them as the foregoing. The shape and structure of its bill and tongue, moreover, preclude the possibility of its obtaining nectar from *Loranthus* flowers in a manner that would conduce to their cross-pollination. I observed it as very partial to ripe figs of the Peepal (*Ficus religiosa*) and the Gulair (*F. glomerata*) as also to the soft juicy portions of Mhowa flowers. At Kannad it was observed to be feeding largely on *Lantana* berries.

Breeding: The gonads of the specimens were in a quiescent state. On 26 March (Kaulās) a pair was observed building at the tip of an outhanging branch in a large *Pithecolobium* tree at a height of about 18′. Both birds were working at the tiny purse of reddish fibres attached along a twig for about 1½″.

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[1] "The Rôle of Sunbirds and Flowerpeckers in the Propagation and Distribution of the Tree Parasite *Loranthus longiflorus* Desr. in the Konkan". J.B.N.H.S., vol. xxxv, pp. 144-149.

In the Nasik District, according to Davidson and Barnes (J.B.N.H.S. iv, 87), it breeds from the end of February through March and April. At Kihim (Kolaba District), Konkan, I have found a nest with two partly fledged young on 11 May.

FAMILY: PITTIDÆ.

Pitta brachyura Linnæus. The Pitta.

Corvus brachyurus Linnæus, Syst. Nat. ed. xii, vol. i (1766) p. 158—Ceylon.

Specimens collected: 35 ♂ 6-10-31 Manāṇūr 2,000′; 150 ♀ 17-10-31 Farāhābād 2,800′.

Elsewhere not noted.

Iris in No. 35 dark brown, in 150 hazel brown; bill orange, brownish on commissure and at tip; mouth in No. 35 pale pink, in 150 brownish orange-pink with bright orange gape; legs and feet brownish flesh colour; claws duskier.

The Pitta was usually met with singly on the Amrābād Plateau, where it was not uncommon, in thorny scrub jungle or heavy Bamboo forest. It was silent. No. 35 had the bill coated with damp mud suggesting that the bird had been digging for food.

Its status in Hyderābād needs to be determined. In a great many portions of its range, the bird is a local seasonal migrant.

Breeding: The organs of the specimens were in an undeveloped condition. No. 150 (17 October) was very fat.

The nearest breeding record we have is from Chānda in the Central Provinces where Macpherson found a nest with young on 30 June (S.F., x, 519).

(*To be continued*).

NOTES ON SOME BIRDS FROM SOUTHERN ARAKAN.

BY

CLAUD B. TICEHURST, M.A., M.R.C.S., F.R.G.S., M.B.O.U.

In January 1930 the Society was able to arrange that Mr. Henricks should accompany Mr. Villar, I.F.S., on a tour through part of South Arakan with the idea of making such a collection of birds of this little-known province as was feasible. Mr. Villar leaving Prome proceeded to Leindon just within the boundary of the Thayetmyo district on January 7. From there he zigzagged along the foothills of the Arakan Yomas, camping at various places till he reached Mindon on January 19th, round which town collections were made till 28th when he proceeded up to Ngakon Forest Rest House (3,000 feet), in the neighbourhood of which, in the Mindon Yoma Reserve, collecting was continued. On February 6th the crest of the Yomas was crossed (4,200 feet) and the party proceeded down the Gamon Chaung to the foothills on the Sandoway side, close to the Kyaukpyu boundary. From the 15th to 22nd they were near Ma-i village (50 feet), and then proceeded along the Indo-Burmese Telegraph line to Taungup which they reached on March 2nd. A detour was made on March 3 to Ngapali on the sea-coast for a week's stay and they then returned to Taungup. From the latter town they went by the Taungup-Prome cart-road to the crest of the Yomas (3,000 ft.). The party descended the Prome side of the Yomas on March 22nd and the tour finished in the Kinyang Reserve, Henzada district, on March 27.

The total collection numbered 357 skins comprising 258 forms, and although there was no large series of any species the collection is an exceedingly useful one, since very few birds have been collected in Arakan since Phayre and Abbot collected there about 85 years ago. Moreover, there were hardly any skins available of those forms which Blyth described from Arakan in the forties of last century—about 27 in number. This collection, then, helps to fill this gap in supplying 13 of these Arakan topo-types. The collection has also produced new forms of *Alcippe nepalensis* and *Stachyridopsis rufifrons,* and has enabled me to add 10 species to the Arakan avifauna.

Unfortunately Mr. Villar is not an ornithologist and so there are no field notes available; I have held back the account of this collection hoping that I could induce Mr. Villar to write some account of the country. Generally speaking the east side of the Yomas are dry bamboo jungle and on the west side damp evergreen jungle.

Finally, I may say that a great deal more collecting must be done in Arakan before we can ascertain what forms inhabit the Yomas, or arrive at any conclusion about distribution.

I have indicated with some precision the exact localities where the specimens have been obtained since birds were collected in the low ground and foothills on each side of the Yomas, as well as on the crest in two localities. The day has long since passed when localities on labels such as Arakan, Chin Hills, Southern Shan States, etc. were considered sufficient; we need more exactness now and looseness in data in the past has become to be a great hindrance to progress in the present.

I have given in most cases the actual locality and the district it is in, as well as the elevation, and all these localities are easily to be found on the Forest maps.

The thanks of the Society are due to Mr. Villar for the great help he has given in making this collection and to Mr. Henricks for the excellent specimens, prepared often under great difficulties.

Urocissa erythrorhyncha magnirostris (Blyth).

Two from Khayauk Chaung and Thani Chaung at the foot of the Arakan Yomas, south of Thayetmyo in January. The white parts of the plumage, when fresh, are a lovely pale pink and the underside of the webs of the primaries a *gloire-de-dijon* yellow. These birds are practically topo-types of the race described from the hills separating Arakan from Pegu. This race is said not to have white tips to the primaries, but both these specimens certainly have them.

♂ W. 206, T. 445, B. 41 from base (35 exp.) ; ♀ W. 190, T. 435, B. 37 (28).

Cissa chinensis chinensis (Bodd.).

One from Ngapali, Sandoway (sea-level). ♂ W. 150, T. 202.

This specimen, now 3½ years old, still retains its green colouration; individual feathers of it removed and placed in sunlight became blue in three weeks. Blyth long ago recorded that specimens in captivity change from green to blue. It would be interesting to know whether this is normal in wild birds when the plumage gets very worn.

Dendrocitta vagabunda sclateri Baker.

Four from Kyauk Chaung, Mibauk and Yaga Chaung in the Thayetmyo Arakan foothills. 4 ♀♀ W. 151-159, T. 247-262.

The Tree-Pie's of Burma have been divided up into forms *sclateri* from the Chin and Kachin hills, *kinneari* from the east of Burma (except Kawkarick Mt. where *saturatior* occurs). From the area of *sclateri* there are only eight adults in the British Museum, only two of which are sexed. These measure W. 145, 156-166, T. 240, 260-285. The smallest measurement is that of the only sexed adult female; the rest appear to be males.

From Tounghoo, the type locality of *kinneari*, there is a small series, and a few others from Rangoon and Pegu. These measure W. 140-155, 157, T. 213-242, 275; three are sexed as males, four as females. It would seem that *kinneari* is a smaller as well as a duller coloured bird, but it will be noticed that the largest bird, a ♂ from Yatho, is as large as most *sclateri*.

I provisionally put these Arakan birds as *sclateri* but the material from Burma generally of this very common bird is too scanty to be sure of races or distribution.

Crypsirhina cucullata Jerdon.

♀ Khyauk Chaung, Thayetmyo. W. 108, T. 185.

Parus major nepalensis Hodgs.

♀ Monda in the foothills, Thayetmyo. W. 64. The white wedge in the penultimate tail feather measures 25 mm.

I cannot differentiate this and other Burmese birds from birds from Nepal. They have a larger (23-30 mm.) white wedge than have *cinereus* from Java (9-20 mm.) and in this and in colour they match Nepal birds, which are smaller and slightly bluer on the upper parts than *kaschmirensis; nepalensis* (ex Burma) ♂ W. 62.5-67.5 against 69-76 in *kaschmirensis*. 5 ♂♂ Java 64-70 mm.

Sitta frontalis corallina Hodgs.

♂ Nabudaung, Sandoway Arakan Yomas. W. 76; ♀ Mindon Yoma, Arakan. W. 73.5.

I have already pointed out that *frontalis* came from Ceylon and that the Northern form is smaller and must bear Hodgson's name.

Garrulax leucolophus hardwickii Ticeh.

Two from Arakan; one from the crest on the Taungup-Prome cart-road and one from Salu in the foothills (1,600 ft.) in Sandoway district. I have already (*J.B.N.H.S.*, xxxiv, p. 669) suggested that probably it would be found that the race of this Laughing Thrush which inhabited the Arakan Yomas would not be the same as the Pegu bird (*belangeri*).

Garrulax pectoralis pectoralis (Gould).

One from Khyauk Chaung, Arakan foothills, Thayetmyo.

Birds with black ear-coverts from Arakan were named *melanotis* by Blyth, but an examination of a large number of this species does not convince me that this feature is constant enough to warrant a separation. It is true specimens from Arakan have black ear-coverts. On the other hand I have seen several from Sikkim similarly marked; on Mt. Victoria birds have white or black or pied ear-coverts. 'S. Burma' is said to be inhabited by *G. p. semitorquata* with buff tips to the tail. In the above specimen the tips are white as in *pectoralis*. There is a good deal of variation in the colour of the underparts in this species; some are much more warm-buff than others and this seems to be purely individual.

Garrulax moniliger moniliger (Hodgs.).

One from Kyat Chaung, Arakan foothills, Sandoway is clearly the typical race and not *fuscata.*

Trochalopteron erythrocephala erythrolæma ? Hume.

One from Mindon Yoma Reserve, Arakan crest (4,200 ft.) is nearest to this race; it has fewer spots on the mantle than any specimen in the British Museum and further specimens from Arakan are desirable. Not previously recorded from Arakan.

Chrysomma sinensis sinensis (Gm.).

Two from Hlwa Chaung and Yin Chaung in the foothills, Thayetmyo district. I note that the winter tails in this species from Burma measure 94-103 mm., often longer than in Indian specimens; Chinese birds have similarly long tails and both these and Burmese birds are no doubt true *sinensis.*

Pellorneum ruficeps minor Hume.

Four; one from Leindon, Thayetmyo and three from Ngapali (sea-level) Sandoway. 2 ♂♂ W. 70, 2♀♀ 65.5-66.

Minor was described from Thayetmyo and I have examined the type—a very bad skin; it and all the above have the dark, pale edged, feathers between the cap and the mantle as *mandellii* has. The streaks on the underparts are finer than in *mandellii* and the ear-coverts and flanks paler. *Minor* W. 64-70, *mandellii* (mostly) 70-74 mm. I think *minor* is a recognizable race and it has a very limited distribution; I have examined skins from the following places. Mt. Victoria, Mt. Popa, Meiktila, San-Kawton Road, Pakkoku district, Sandoway, Henzada and Thayetmyo. Birds from Mingin and Kain, (Upper and Lower Chindwin), are near *mandellii.* Birds from Tenasserim, 'Pegu', Rangoon, Tounghoo, Karennee, and 'S. Shan States' are *subochraceum,* which lack the dark feathers between the cap and the mantle.

The upper parts in all races of *ruficeps* vary very much; in *minor* I note the upper parts as richer olive-brown and greyish olive-brown in birds shot at the same place on the same day. *Minor* has certainly nothing to do with *subochraceum,* as has been suggested by some, and it may be that the latter should stand as a separate species.

Stachyridopsis rufifrons pallescens Tice. (Bull., B.O.C., liii, p. 18, October 1932).

Mr. Villar followed the Gamon Chaung from the Ngakon Forest Rest House, Mindon Yoma, as he proceeded westwards from the crest of the Yomas and at the foothills at 500 ft. on this stream (Sandoway district) he obtained this bird. It differs markedly from both *rufifrons* (Pegu Hills) and *ambigua* (N. Cachar). From the former it differs in being less brown, more olive-grey on the upper parts, edge of wing and tail, and paler below, having a creamy wash on the under-parts and flanks instead of buff. Not previously recorded from Arakan.

Mixornis gularis rubricapilla Tickell.

Five from foothills, Thayetmyo district and one from Ngapali, Sandoway district. All are the same and belong to the above race and not to *sulphurea* with finer throat streaks.

Alcippe nipalensis stanfordi Ticeh.

In the *J.B.N.H.S.*, xxxiv, p. 672, I drew attention to this *Alcippe*, which inhabits the Arakan Yomas, from a specimen obtained by Mr. J. K. Stanford at Nyaunggyo on the crest of the Yomas by the Taungup-Prome cart-road, and I pointed out that it differed considerably from any known race of *nipalensis.* I, however, hesitated to name it from two specimens. Fortunately Mr. Villar's collection contained three more from exactly the same locality and so I named this Arakan race (Bull., B.O.C., l, p. 84, 1930) as above. It is more olive-grey on the back, edges of wings and tail, instead of olive-brown as in *nipalensis*, and the underparts are considerably paler. It also occurs on Mt. Victoria.

Alcippe poiocephala phayrej Blyth.

Four specimens; one from Gamon Chaung, Kyaukpyu-Sandoway boundary, one, the crest of the Yomas at Nyaunggyo and two, the foot of Yomas at Nyaungchidauk on the Prome road. These, with Mr. Stanford's series of Arakan birds, all topo-types of *phayrei,* clearly show that the Assam bird is not the same and should be called *fusca* of Godwin Austen (*J.A.S.B.*, xlvii, p. 197). The type is in the British Museum from the Naga Hills. This race is much more rufous on the upper parts, especially on the lower back, upper tail-coverts and edge of the wing, and the under parts have a brighter rûfous wash instead of cream-colour as in *phayrei.* To *fusca* belong birds from Naga Hills, Cachar and Tippera; those from Manipur are slightly intermediate and those from Upper and Lower Chindwin and Mt. Victoria are *phayrei.* A series of *phayrei* from Arakan measure W. 68.5-72, T. 64-66.5, B. 15.5-17 (13-14 exp.).

Actinodura egertoni ripponi O. Grant.

One from Gamon Chaung, Kyaukpyu-Sandoway boundary at 2,250 ft. on the crest of the Yomas. Hitherto only recorded from Mt. Victoria and the Chin Hills.

Staphidia castaneiceps castaneiceps (Horsf. & Moore).

One from the crest of the Yomas on the Taungup-Prome road. From examination of Staphidias in the British Museum I must come to the conclusion that *rufigenis*, *striata* and *castaneiceps* are all one species. There are specimens of *rufigenis* from Sikkim, Manbhum and Brahmakund (N. Assam); *striata* from S. Shan States, Tounghoo and N. Tenasserim, and *castaneiceps* from Manipur, Khasia Hills, 'S. Assam Hills', Garo Hills, Chin Hills and Mt. Victoria. From the Naga and Lhota Naga hills there are three birds which have the striated head mixed with chestnut and are intermediates. Should this be constant in this area they might well stand as a linking race.

Herpornis zantholeuca zantholeuca Blyth.

Three specimens, from the crest of the Yoma above Mindon and from the foothills on each side.

Though Blyth made a slip in compounding this word as *Erpornis*, the rules of nomenclature clearly allow for amendment to *Herpornis.*

Aegithina typhia typhia (L.).

Three from Mindon, Thayetmyo, and Mai, Sandoway from low elevations.

Chloropsis aurifrons aurifrons (Temm. & Laug.).

Five from the low ground near Mindon, Thayetmyo.

Chloropsis hardwickii malayana Roh. & Kloss.

One from the crest of the Yomas on the Taungup-Prome road. ♂ W. 88.

Chloropsis cochinchinensis cochinchinensis (Gm.).

Two from Mindon Yoma (2,250 ft.) and one from Mai, Sandoway (50 ft.). ♂ W. 89; ♀♀ W. 77.5, 81.5.

Criniger flaveolus flaveolus (Gould).

A pair from Gamon Chaung (500 ft.) near Sandoway-Kyaukpyu boundary. W. 103.

There has been considerable confusion over the forms of *Criniger* inhabiting Burma. *The Fauna of British India*, Birds, edn. ii, Vol i gives five races of *Criniger tephrogenys.* In Vol. vii these are rearranged into two and three forms of two species, viz. *Criniger gutturalis ochraceus*, and *C. gutturalis henrici* (replacing *grandis*); and *C. gularis flaveolus, burmanicus, griseiceps.* In vol. viii it is explained that there are two species and that as the name *tephrogenys* is preoccupied, *gularis* is used instead. Apart from the fact that *gularis* is much the older name of the two and should have been used, if tenable, in the first case, the fact is that it is not *tephrogenys* which is preoccupied but, as Hartert and Collin pointed out (Novit. Zool. 1927, p. 51), *Turdus gularis* of Horsfield (=*Criniger gularis*) 1822 is preoccupied by *Turdus gularis* Latham (Supp. Ind. Ornith. 1801, p. xi) (=*Cinclus gularis*).

The next oldest specific name is *flaveolus.* I have examined all the specimens in the British Museum of Burmese *Criniger* more than once and it is evident that a great deal more field-work and collecting will have to be done on these birds in Burma before a quite satisfactory arrangement of this difficult group is arrived at and the interest in them centres round Eastern Pegu and Northern Tenasserim.

To begin in the north, *C. flaveolus* is found in the north-east sub-Himalayan tract through Assam to Burma where it is found, so far as is known, in the Lower Chindwin in the Katha District, and in Arakan. The measurements of the wing given in the Fauna, edn. ii are 88-96; I measure a long series has W 98-108 mm.

Criniger flaveolus burmanicus Oates.

The series in the British Museum shows that this bird ranges from the Tounghoo and Karen Hills, Karennee and S. Shan States southwards to Tavoy in Tenasserim. That is to say it extends past the area *robinsoni* inhabits into the range *C. gutturalis ochraceus*....In the *Journ. Bomb. Nat. His. Soc.*, xxxiv, p. 901 I rather doubtfully referred the Arakan *Criniger* to *burmanicus;* further examination with more material from Arakan convinces me that the Arakan birds are *flaveolus.* On comparing *burmanicus* and *flaveolus* with the Javanese bird (*gularis* of Horsfield) one would hardly hesitate to say that here we have geographical representatives of one species. From *flaveolus* the most striking difference is the larger amount of grey in the forehead and crown. A long series measure W 100-107 mm.

Criniger gutturalis ochraceus Moore.

In the *Fauna*, edn. ii this bird seems to have been missed out altogether for, although in Vol i, p. 362 there is an account of *Criniger tephrogenys tephrogenys* and in Vol. vii the name is altered to *Criniger gutturalis ochraceus*, the account of the bird at p. 362 belongs to *tephrogenys* and not to *ochraceus.* Hence the distribution 'extreme South Tenasserim' does not apply. *Ochraceous* is found in Tenasserim from at least as far north as Ye, southwards to the limit of Tenasserim and into Peninsular Siam (Chong Trang etc.) and has an extensive range eastward into Cochin-China.

Now at Chong Trang the true *Criniger tephrogenys tephrogenys* also occurs and, therefore, the two cannot be conspecific. Reference to *Criniger gutturalis gutturalis* of Borneo leaves little doubt that *ochraceus* is a race of that bird.

Criniger gutturalis is said to be preoccupied (Delacour (L'Oiseau, Vol. x, no. 12, 1929)). I can find no grounds for this statement. The species was described as *Tricophorus gutturalis* by Bonaparte in 1850 and this is not set aside by *Turdus gutturalis* of Müller, which is a South African Shrike. Though Bonaparte seems to have taken the name from a label or a MS of Müller's, he described the bird as *Tricophorus gutturalis.*

Criniger tephrogenys robinsoni Ticeh. (Bull. B.O.C., liii, p. 19, October 1932).

At Yea, Amherst and Moulmein there occurs a White-throated Bulbul hitherto overlooked, which could be referred to no known form. There are specimens from each of the above places in the British Museum and to the late H. C. Robinson belongs the credit of first differentiating them. Robinson was evidently working at the group shortly before he died and left MS. in a box with the specimens in the British Museum; however, he never gave this form a name nor indicated to which species he referred them. To draw attention to these birds I have recently named them after Robinson. Until we have more information on the White-throated Bulbuls of N. Tenasserim and more specimens, a final decision cannot be reached as to which species these birds represent. At Yea, *Criniger gutturalis ochraceus* certainly occurs, so that on the face of it *robinsoni* cannot be a form of *gutturalis;* nor is the bird in the least like *gularis burmanicus* which occurs in North Tenasserim also. From *ochraceus*, *robinsoni* can be distinguished by the more yellow-green colour, not so grey, of the upper parts, and from *tephrogenys* by the head being concolorous with the back and having paler under-tail coverts. Tentatively I put *robinsoni* as a race of *tephrogenys* which has no representative in Tenasserim. Further research may show that *robinsoni* has a different distribution in elevation than *ochraceus;* that is one of the many points in this group for future collectors to pay attention to.

Criniger tephrogenys griseiceps Hume.

Hume described this bird in 1873 and from then until Oates published Vol. i of the *Fauna* (edn. i) in 1889 this and *burmanicus* were confounded.

Hence in all notes on the species prior to 1889 *burmanicus* was included under *griseiceps*.

Oates, who supplied Hume with the specimens, obtained them in the evergreen forests of the E. Pegu Hills and he gives the range in these Hills as from the latitude of Thayetmyo to that of Rangoon. Since then, we have no information on this bird and no one seems to have met with it; at least there are no specimens in the British Museum other than Oates's five original ones, and sight records cannot be accepted.

Criniger burmanicus certainly occurs in the Tounghoo Hills, Karen Hills, Karennee, Pahpoon etc. and so occurs in the same area as *griseiceps* and is so unlike the latter that I think the two cannot be conspecific. I, therefore, tentatively place *griseiceps* as a form of *tephrogenys* and *robinsoni* seems to be a connecting link.

Microscelis psaroides nigrescens Baker.

Three from Mindon Yoma, 3,000 ft.

Molpastes cafer burmanicus Sharpe.

Two from the low country between Thayetmyo and Mindon.

Xanthiscus flavescens flavescens Blyth.

Three birds from Mindon Yoma 3,000 ft.
This bird was described from Arakan by Blyth and these three may be taken as topotypes. As regards the yellow in the under parts, this is present on the belly, vent and undertail coverts, but the amount on the breast has to be looked for. In birds from Tenasserim and the Shan States the upper-parts are a little darker and the yellow on the breast is obvious at a glance; these are *vividus* of Baker. Birds from the Chin Hills and Assam are quite the same as Arakan birds, and therefore *X. f. pallens* of Kloss becomes a synonym of *flavescens* (not of *vividus* as stated in *The Fauna*, ed. ii, vii, p. 80). 3 ♂♂ W. 87-88.5.

Otocompsa flaviventris flaviventris (Tickell).

Two from Khyauk Chaung (650 ft.), Thayetmyo, and one from Kyaukpyu-Sandoway boundary (150 ft.) are the same as Bengal birds.

Iole virescens virescens Blyth.

Four from Ma-i, north boundary of Sandoway, and Ngapali, Sandoway both at sea-level; and from the crest of the Yomas on the Taungup-Prome Road (3,300 ft.). These are topotypes of the race. W. 79.5-85 mm.

Mons. J. Delacour considers (L'Oiseau, vol. x, December 1929) that *Iole lonnbergi* and *Iole cinnamomeoventris* are indistinguishable from *Iole propinqua* of Oustalet (type locality, Pa Mou, near Red River, Tonkin). With this I cannot agree. A series from Tonkin measure W. 85-94 mm., whereas Tenasserim birds measure W. 78-84 mm.; *propinqua* is also a darker bird. *Iole cinnamomeoventris* was described from Tenasserim Town, and the type and birds from farther south in Tenasserim agree fairly well and seem separable. Birds from Northern Tenasserim I cannot differentiate from *virescens*. I do not feel at all sure, however, that *cinnamomeoventris* is separable from *lönnbergi* described from N. Siam.

Pycnonotus finlaysoni davisoni (Hume).

Two males from Ma-i and Ngapali, Sandoway. W. 88, 91 mm. The type locality is not Arakan as given in *The Fauna*, ed. ii, but '12 miles north of Rangoon'. Not previously recorded from Arakan.

Pycnonotus blanfordi blanfordi Jerdon.

One from Monda near Thayetmyo is a topotype.

Saxicola caprata burmanica Baker.

Two from Tonbo, Prome, and Taungup, Sandoway in the plains. Males from Luzon, Lombok, Timor etc. (*caprata*) W. 68-74, B. 14.5-15.5; males from Burma W. 66-73, B. 13.5-14.5. A poor race separably only on slightly shorter bill. The wing measurements for *caprata* in the *Fauna* (ed. ii) are quite wrong.

Saxicola torquata stejnegeri Parrot.

One at the foot of the Mindon Yoma (400 ft.).

Rhodophila ferrea ferrea (Gray).

Three, Salu, Sandoway (1,600 ft.) and Mindon Yoma (3,000 ft.).

Enicurus immaculatus (Hodgs.).

Two from Khayauk Chaung, foot of the Yomas, Thayetmyo.

Calliope calliope (Pall.).

One from Khayauk Chaung.

Copsychus saularis saularis (L.).

Five specimens from the foothills on both sides of Arakan Yomas, in Thayetmyo, Prome and Sandoway districts.

Kittacincla malabarica indica Baker.

Two males, Khyangin Reserve, Henzada and Ma-i, Sandoway, both in the plains. Birds from Northern India and Burma differ from the typical form from Malabar in the shortness of the tail.

Turdus dauma dauma Lath.

One; Ma-i, Sandoway.

Zoothera marginata Blyth.

One from Nyaunggyo (3,000 ft.) (♀ W. 134, B. 34, 26 exp.) is a topotype.

Monticola solitaria affinis Blyth.

One near Mindon, and one halfway between Taungup and the crest of the Yomas (1,300 ft.) on March 13.

Myiophoneus temmincki temmincki (Vig.)

One: Hlwa Chaung near Thayetmyo, west side of Irrawaddy.

Myiophoneus temmincki eugenei Hume.

One: Sadon Chaung near Thayetmyo, west side of Irrawaddy. These last two birds were obtained on 24th and 17th of January on two small tributaries of the Mindon Chaung within eight miles of each other.

Muscicapula hodgsonii (Verr.).

Two males from Mindon Yoma February 3rd and 5th at 3,000 ft. New to Arakan.

Muscicapula melanoleuca Blyth.

One from Taungup-Prome road, Sandoway, at 2,300 ft., March 16.

Muscicapula rubeculoides rubiculoides (Vig.).

Six specimens between January 7th and February 5th from Leindon and Monda, Thayetmyo in the foothills and one from Mindon Yoma 3,000 ft.

Muscicapula rubeculoides dialilœma (Salvad.).

One from the Mindon Yoma (3,000 ft.) on February 5th. The distribution of these two forms in Burma badly needs investigation; both seem to occur together in winter. In Arakan too the question is complicated by a third form, *rogersi* described from Arakan by Mr. Kinnear.

Muscicapula olivaceus poliogenys (Brooks).

Two from Gamon Chaung (500 ft.), Sandoway, February 9.
Not previously recorded from Arakan.

Anthipes monileger gularis Blyth.

By a fortunate chance a specimen of the White-gorgeted Flycatcher was taken on March 16th, near the crest of the Arakan Yomas in the Sandoway district (2,600 ft.). As long ago as 1847, Blyth described this bird from Arakan and it had apparently not been obtained since. This specimen clearly shows that the Arakan race is nearer to *leucops* than to the typical form, from which it differs much in the same way as the races of the two species of *Alcippe* do; that is to say, the upper-parts and wing edges are much paler olive-brown, cheeks and ear-coverts paler grey, and it is paler on breast and flanks.

Hypothymis azurea styani (Hartl.).

Six specimens from the plains and foothills on both the Thayetmyo and Sandoway sides of the Yomas.

Lanius colluroides colluroides Less.

Lanius cristatus cristatus L.

One of each from the foot of the Mindon Yoma.

Hemipus picatus picatus (Sykes).

Four from the foothills on the Thayetmyo side and Gamon Chaung, Khyaukpyu (2,250 ft.).

Tephrodornis gularis pelvica (Hodgs.).

Four from the Yomas (2,200-2,700 ft.) in the Mindon Yoma Reserve and from the Taungup-Prome Road. W. 113-120. Rather intermediate in size between *pelvica* and *annectens* as I have before recorded from Arakan (*J.B.N.H.S.*, xxxiv, p. 906).

Pericrocotus speciosus elegans (McClell.).

Four from Sadon Chaung, Thayetmyo (300 ft.); one from Thani Chaung, Prome (1,700 ft.) and one from Mindon Yoma (1,700 ft.). The first two primaries lack the red spots in the males and the first three lack the yellow spots in the females. ♂ W. 92.5-96.5, T. 88-94; ♀ W. 92.5-95, T. 90-91. I have already dealt with the validity of this race.

Pericrocotus brevirostris neglectus Hume.

A male from the crest of the Yomas on the Taungup Road on March 16. W. 84.5, T. 90.

Pericrocotus roseus roseus (Vieill.).

A male from the crest of the Yomas on the Taungup Road on March 16.

Graucalus macei siamensis Baker.

Two males from Mindon Yoma (3,000 ft.). W. 180, 183; a female from Kyauk Chaung in the foothills (1,000 ft.). W. 179.

Artamus fuscus (Vieill.).

Two from Kyaungin Reserve, Henzada (100 ft.) and one from Hman, Thayetmyo (400 ft.).

[**Dicrurus macrocercus** (Vieill.).

I have recently examined all the Black Drongos in the British Museum as well as many others in Mr. Whistler's and my own collections, and from Colombo Museum, those of the Madras Survey and a series of breeding birds from Bengal and as my results do not quite tally with the account given in the *F.B.I.* ed. ii. I take this opportunity to give a résumé of them.

In the first place in the *Fauna* the type of *Dicrurus macrocercus* is said to have come from 'India, restricted to Orissa'. *Dicrurus macrocercus* of Vieillot (1818 was based on plate 174 in vol. iv of LeVeillant's *Ois. Afr.* No locality is specified. In 1823 Lichtenstein based his *Muscicapa biloba* on the same plate; *Dicrurus bilobus* (Licht.) becomes therefore a pure synonym of *Dicrurus macrocercus*. Cabanis (Mus. Hein. iii) fixes the type locality of *D. bilobus* as Java and, therefore, the type locality of *D. macrocercus* must also be Java. The type locality for *macrocercus* was again restricted to Java by Lord Walden in Blyth's *Birds of Burma*, p. 129.

In the second place, series of measurements of Drongos in which first year birds and adult birds are mixed together are quite useless and misleading. It is the mixing of these two together which gives the very small minimal measurements in the *Fauna* and which makes average measurements meaningless. To take two examples:—In the British Museum there are from Nepal 7 adults and 5 first year birds (the latter recognizable after the post-juvenile moult by the browner, less glossy wing feathers), and these measure:

Adults: W. 152-161.
First year: W. 143-152.

Or again, a series from the Punjab measure:

Adults: W. 145-158, T. 156-179
First year: W. 137-149, T. 144-152.

All the above birds are *D. m. albirictus*, but in *The Fauna* the average measurements given for this race W. 149.1, T. 159.5, are too short in the wing, and in the tail only just reach the minimum for adult birds. Hence it is obvious that the average measurement for any race can be reduced or increased by including more or fewer first year birds. In the measurements which I give below only adults are included.

1. **Dicrurus macrocercus macrocercus** (Vieill.)

The Javan race is a bird with a short wing, as in the Ceylon form, but with a long tail. 10 ♂♀ W. 128.5-139, 142, T. 141, 145, 146, 154-167.

Obs.—Series not good; very old specimens; none dated. Probably the short-tailed birds are visitors? Javan birds seem more intensely black with more violet-blue than green gloss and to have narrower tail feathers than in other races. Rectal spot always absent.

2. **Dicrurus macrocercus minor** Layard.

The shortest winged (with the Javan bird), and the shortest tailed form.
10 ♂♀: W. 126, 130-140, T. 131-147.

3. **Dicrurus macrocercus albirictus** Hodgs.

The largest winged and longest tailed form; white rectal spot usually present.

7 ♂♀, Nepal: W. 152-167, 161, T. 167-175, B. 25-28 (Topotypes).
13 ♂♀, North-West Himalayas: W. 145-159, T. 159-180, B. 24.5-27.
18 ♂♀, Punjab Plain: W. 145-156, T. 156-179, B. 24.5-27.
10 ♂♀, United Provinces: W. 143-157, T. 152-171, B. 24.5-27.5.
18 ♂♀, Bengal: W. 143-154, T. 152-180 (11 of them breeding birds), B. 24-27.5.

Obs.—In all the measurements I have had to include together the measurements of males and females as sufficient series from all over the range of the Black Drongo of properly sexed birds do not exist. The best sexed series are those from the Punjab and judging by these the sexes of Black Drongos cannot be differentiated on measurement as there is a large overlap both in wing and tail measurements in the two sexes. The females tend to have the shorter wings and tail and the smaller bill.

The excellent series of breeding birds collected in Calcutta especially for this revision shows that these birds cannot be separated from *albirictus*.

4. **Dicrurus macrocercus peninsularis** Tice. (Bull. B.O.C., October 1932).

When we come to consider the Black Drongo from the south of the (roughly) Gangetic Plain the facts are clear enough though the interpretation into zoological nomenclature is more difficult. The facts are that, as in so many cases, the birds from the Peninsula of India become gradually smaller from north to south, until in Ceylon the smallest birds (*minor*) are found. Already a slight diminution in size is seen in the birds from the United Provinces though these are best united with *albirictus*. A further diminution in size is seen in birds from the Central Provinces.
9 ♂♀: W. 141-148, T. 147-164.
while those from Hyderabad, Deccan, measure
9 ♂♀: W. 138-152, T. 137-162.
Decidedly smaller again are birds from Madras Presidency.
20 ♂♀: W. 130-145, T. 135-161, B. 23-26.

The only two I have seen from Travancore seem much the same as the last
♂♀: W. 136-143, T. 147-151.

In the *F.B.I.* ed. ii, it is considered that the Bengal race extends throughout India to the extreme south and migratory movements are called in to explain the presence of small birds in the range of the larger race and vice versa. My examinations have not confirmed this and, as I have already stated, small birds occur in every race and are first year birds.

I have already shown that birds from Bengal are not separable from Nepal birds. Birds from the Madras Presidency and Hyderabad show much the same measurements whether they are summer or winter birds and since there is very little overlap between them and *albirictus* it seems clear that *albirictus* does not wander, at all events, as far south as these Provinces. As birds from the Peninsula of India cannot be placed with *albirictus* nor with *minor*

I have had no alternative but to give them a name but, as explained above, *peninsularis* grades into *albirictus* as one proceeds north.

The differences between the Madras birds and *albirictus* were clearly pointed out by Jerdon (Ibis 1872, p. 119) and *peninsularis* is, of course, the same bird as described by Herman from Tranquebar as *Muscicapa atra*, a name which is pre-occupied.

5. **Dicrurus macrocercus cathæcus** Sw.

Birds from South China have the following measurements:—

16 ♂♀: W. 142-150, T. 137-154. Bill from skull 24-27, mostly 27.

These birds are almost of the same size as *peninsularis*, the tails are not quite so long and the bill is decidedly larger. The white rectal spot is often absent, but not invariably so. This is the only race in which, in adults, the tail may be shorter than the wing. I find that the tail exceeds the wing in length by—7 to +5mm.; in the Javan race the other extreme is found and in most birds the tail exceeds wing by +18 to +30 mm. In other races the measurement is about+5 to+25.

To this race I assign all birds from Tenasserim:—

16 ♂♀: W. 139-153, T. 133-153, B. 25-26 mm.

In the *F.B.I.* ed. ii, birds from 'extreme south-west and south Burma' are said to belong to the Javan race. The localities cited are vague, but if any birds belong to the Javan race one might expect those of Southern Tenasserim to do so. However, out of six birds thence five are too long in the wing and all are short in the tail for that race. They fit better with *cathœcus*.

Material from Burma proper is none too plentiful; winter birds from Rangoon, Pegu, Tounghoo, Karennee and Southern Shan States all fall within the measurements of *cathaeus* and a breeding bird from the Yunnan border near Bhamo I also place as *cathœcus*. I have examined single birds from Akyab, Henzada, Rangoon, and several from the Chindwin which do not seem to be different to *albirictus* and have tails 162-170. These are all winter birds. Probably in Upper Burma *cathaecus* grades with *albirictus*.]

Dicrurus leucophœus mouhoti (Wald.).

A female on Mindon Yoma (1,700 ft.). W. 140, T. 155.

Chaptia œnea œnea (Vieill.).

Three males from the foothills of Prome and Thayetmyo districts. W. 119-124.

Chibia hottentota hottentota (L.).

Five from the foothills on both sides of the Arakan Yomas in the Sandoway and Thayetmyo districts. ♂ W. 161-168; ♀ 156-158. The long 'hairs' on the head in this bird do not spring from the posterior part of the crown (Cf., *Fauna*, ed. ii, p. 370) but from the base of the bill.

Dissemurus paradiseus rangoonensis (Gould.).

Two from the foothills, Thayetmyo district. ♂ W. 173, T. 440, B. 37.5 from base; ♀ W. 162, T. 345, B. 32.

Orthotomus sutoria patia Hodgs.

One from the foothills of the Yoma, Thayetmyo district.

Franklinia gracilis (Franklin).

Three from the foothills in Thayetmyo district. 2 ♂ W. 44.5, 46, T. 51, 52.5; ♀ W. 45, T. 48.5.

Franklinia rufescens rufescens (Blyth).

One from the crest of the Yomas on the Taungup Road; topotype.

Phragmaticola aedon (Pall.).

One from Ma-i, Sandoway (50 ft.).

Phylloscopus affinis (Tickell).

Phylloscopus nitidus plumbeitarsus (Sw.).

One of each from Sadon Chaung, Thayetmyo (300 ft.).

Prinia inornata blanfordi (Wald.).

One from Pemyauk Chaung in the foothills, Thayetmyo district.

Irena puella puella (Lath.).

Four; Kaukyodama Chaung, Sandoway-Kyaukpyu boundary (sea-level) and Ngapali, Sandoway (sea-level).

Oriolus xanthornus xanthornus (L.).

Three; Thani Chaung, Prome and Leindon and Monda, Thayetmyo. These are not distinguishable from Himalayan examples.

Oriolus traillii (Vigors).

Three from Mindon Yoma (3,000 ft.). A female on February 2nd had ova in ovary well advanced in size; the throat is almost as black as in an adult male, but the rest of the underparts streaked. W. 136. Another female has the throat streaked like the rest of the underparts and the tail feathers narrower, evidently a one year old bird; W. 130.

Gracula religiosa intermedia (L.).

Specimens from Taungup, Sandoway (50 ft.) and from the Mindon Yoma (3,000 ft.).

Sturnia malabarica nemoricola Jerdon.

Mindon Chaung, Thayetmyo (400 ft.).

Gracupica burmanica (Jerdon).

Three from low hills near Thayetmyo are topotypes. ♂ W. 119-122.

Ploceus infortunatus burmanicus Ticeh.

Five males and four females from near Taungup, Sandoway (50 ft.) and from Mindon Chaung, Thayetmyo (300 ft.). ♂ W. 72-77; ♀ 70-74 mm. All are typical *burmanicus.* As I pointed out (Bull. B.O.C., vol. lii, pp. 104-5) *passerinus* and *atrigula* could not be used for this Weaver and I, therefore, named it *burmanicus.*

Ploceus manyar flaviceps Less.

One from Mindon Chaung, Thayetmyo, January 19, appears to be this and not *peguensis.* Further specimens and observations on Weavers in Burma are desirable.

Uroloncha striata subsp. ?

In the report on the Prome collection made by Mr. Stanford (*J.B.N.H.S.*, xxxiv, p. 911) I left the determination of the Arakan White-backed Munia open, as only one specimen was available. Although there are four in this Arakan collection from the foothills on the Thayetmyo side, not one is in full adult plumage.

Passer flaveolus Blyth.

Three males from the foothills of the Yomas on the Thayetmyo side.

Emberiza rutila Pall.

Three; Taungup-Prome Road (2,900 ft.) on March 19 and Mindon Yoma (3,000 ft) on February 1. 2 ♂♂ W. 77.5, 80; ♀ W. 72.

Melophus lathami (Gray).

One: Taungup-Prome Road (2,900 ft.). As I have pointed out (Bull., B.O.C., October 1932) *melanicterus* cannot be used for this Bunting as the name is founded on a plate of a *Hypochera.*

Hirundo smithi filifera Stephens.

One from Yin Chaung (400 ft.), Thayetmyo.

Hirundo daurica japonica (Tem. & Schl.).

Three from Hlwa Chaung (275 ft.), Thayetmyo, and one from Taungup-Prome Road (2,500 ft.), Sandoway. These are slightly larger and more coarsely streaked than *nepalensis.*

Motacilla alba leucopsis Gould.

Three; Thuni Chaung, Prome; Khyauk Chaung, Thayetmyo; Gamon Chaung, Sandoway; all in the foothills.

Not previously recorded from Arakan.

Motacilla cinerea caspica (Gm.).

One; Kyauk Chaung, Thayetmyo.

Motacilla flava simillima Hart.

Two males from Sadon Chaung, Thayetmyo (300 ft.).

One gathers from the *Fauna* ed. II, vol. iii that, excluding a single record of *taivana*, the Blue-headed Wagtail which occurs in Burma is *thunbergi*. There are two types of *M. flava* in Burma; one is a bird which exactly matches *thunbergi* except that it has a noticeably longer and rather stouter bill, and has rather longer hind-claws. The differences are small ones, but it is noticeable that many of the Burmese birds and all of those which occur in China on passage in spring—Yangtse Valley, Fokien, Shaweishan, Kiang-su, etc.—show these distinctions. I measure *thunbergi* ♂ Bill from skull 15-16.5, hind claw 8.5-10.5 mm.

These eastern birds, which are *macronyx* Stresemann, measure ♂ Bill from skull 17.5, hind claw 12.5 mm.

The other form is a bird with a white eye-streak and very dark ear-coverts and these exactly match Kamsckathcan breeding birds—*simillima* of Hartert. I think *thunbergi* may, however, also occur in Burma.

Dendronanthus indicus (Gm.).

Two; Thani Chaung Reserve, January 10; Kyangin Reserve, Prome, March 27.

Anthus hodgsoni Richm.

Five specimens; from the crest of the Yomas at Mindon Yoma and on the Taungup Road, and from the foothills in Henzada and Sandoway districts; latest date March 27.

Anthus rufulus rufulus Vieill.

Four; Taungup and Ngapali, Sandoway (sea-level) and near Thayetmyo.

Chalcopareia singalensis assamensis Kloss.

Two from Khyauk Chaung (600 ft), Thayetmyo.

Kloss's name was published on May 7, 1930, Baker's *rubinigentis* on May 14, 1930.

Cinnyris asiatica intermedia (Hume)

From the foothills, Thayetmyo.

Arachnothera magna magna. Blyth.

One from Nyaungchidauk (200 ft.), Prome at the foot of the Yomas. This bird certainly belongs to the typical race; it is interesting to note that Mr. Stanford obtained the other race (*aurata*) about 40 miles distant from Nyaungchidauk at Theme in the Pegu foothills on the other side of the Irrawaddy valley.

Archnothera longirostra (Lath)

One from Gamon Chaung, Kyaukpyu (500 ft.). Blyth (*J.A.S.B.*, xv, p. 43, 1846) described a race *affinis* from the east coast of the Bay of Bengal, Arakan to Malacca and as the name was pre-occupied by Horsfield he changed it (*Cat. B. As. Soc.*, p. 328) to *pusilla*. I cannot, however, differentiate this single bird from the typical form from Bengal.

Diceum cruentatum ignitum (Begbie.)

One; Mindon Yoma (2,250 ft.).

Diceum concolor olivaceum. Wald.

Two: Taungup road (2,900 ft.) and Ngapali (sea level) Sandoway.

Not previously recorded from Arakan.

Pitta nepalensis (Hodgs.)

One: Mindon Yoma reserve (3,000 ft.).

Pitta cyanea cyanea Blyth.

One; Prome-Taungup road (2,000 ft.); topotype.

Picus viridanus viridanus Blyth.

Four from between Ma-i and Taungup along the line of the Indo-Burma telegraph, Sandoway, (50-100 ft.) W. ♂ 140; 141.5 ♀, 144, 144, B. ♂ 36.5; 38, ♀ 36, 37-5 from base. Topotypes.

In spite of Mr. Kloss' excellent note on the forms of *Picus vittatus*, *P. viridanus*, and *P. xanthopygæus* (*striolatus* auct.) (Ibis. 1926), Mr. Baker (*Fauna* ed. ii, vol. viii) still maintains that all three are conspecific. The distribution in Burma of *viridanus* and *xanthopygæus* according to Mr. Baker's idea is that the latter inhabits the Chin Hills and the former the rest of Burma. This distribution may fit in with his theory, unfortunately, however, it does not tally with the facts. Owing to Mr. Baker's inability to distinguish these two birds he has overlooked, as Kloss already pointed out, that *xanthopygæus* extends very much further south in Burma and has been obtained in Thayetmyo, Prome, Tounghoo as noted by Oates and Tweeddale and in the Pakkoku district (Rippon) (Specimens in the British Museum). *Picus viridanus* also occurs at Tounghoo and in Pegu and, therefore, I consider that these two birds cannot be conspecific. Moreover in Burma there is no sign of any intergradation between the two, each specimen being at once referable to either *viridanus* or to *xanthopygæus*. The wings of *viridanus* in the *Fauna* are given as measuring 125-148 mm.; none is as small as 125, the smallest ♂ measures 135. This woodpecker does not vary throughout its range in Burma and Tenasserim, but as soon as the Kakchan estuary is crossed a smaller (W. 126-132) and darker bird is found in Perlis State and is *meridianus* Kloss. (Ibis, 1926, p. 689.)

As regards *Picus xanthopygæus* (*striolatus* olim.) Mr. Baker has separated the N.W. Himalayan form as *P. x. dehree.*, because of its larger size. *Picus xanthopygæus* came from Nepal and a series from Nepal and Sikkim I measure as ♂ 126-137. Of the N.W. Himalayan bird I measure 12 ♂ ♂ as 131, 135.5-142. From the Nilgiris 9 ♂♂ 126.5, 130-138; from other parts of S. India 10 ♂ ♂ 128-134.5. Only three of the N.W. Himalayan birds exceed those from other parts of India and therefore, I cannot consider *dehrae* a recognisable race. Though Mr. Baker gives wing measurements of *xanthopygaeus* as 122-130, in the Key it is given as '110-130 nearly always under 125 mm.'; this latter is quite wrong.

The wings of Burmese birds measure.—11 ♂♂ 135-144.

It will be seen that some large birds are found in N.W. India, in the Nilgiris and in Burma, and it seems probable that if larger series were available any difference in wing length in any defined geographical area would largely disappear. Certainly if one accepts *dehrae* one must admit that it also occurs in Burma with a discontinuous distribution from N.W. Himalaya.

Picus canus hessei (Gyld.)

Four; from foothills below the Mindon Yoma Reserve (at 400-600 ft.), Thayetmyo, 3 ♂ W. 150-156 B 41-44 ♀ W. 158 B 41 mm. from base. Males of *hessei* W. 142-156; of *gyldenstolpei* 140-146, series measurde of each. *Hessei* averages longer in wing and bill but the two forms are not very distinct.

Picus chlorolophus chlorophoides (Gyld.)

Two; Yinchang (600 ft.) and Mindon Yoma (3,000 ft.), Thayetmyo. This is the same as *burmae; chlorophoides* was described from Koon Tan, Siam. Birds from S. Shan and from Sai Yohi, Siam are the same as Burmese birds.

Chrysophlegma flavinucha flavinucha (Gould)

One from Mai-i, Sandoway and a juvenile from the crest of the Yomas on the Taungup road on March 18.

Juvenile ♂. Like adult above but the crest paler yellow; gular streak pale yellow, chin and throat white spotted with black; rest of underparts as adult, but belly greyer.

Dryobates atratus (Blyth).

Two from Mindon Yoma (3,000 ft.). Not previously recorded from Arakan.

Dryobates analis longipennis. (Hesse)

One; Hman (400 ft.), Thayetmyo ♀ W. 95.

Dryobates nanus canicapillus (Blyth)

A pair were obtained on the Taungup-Prome road (2,900 ft.) and another pair at Chaungri Chaung (120 ft.) Kyaukpyu-Sandoway boundary. The pair from the low ground differ from the pair from the crest of the Yomas in having, like the rest of Burmese birds, sharper and finer streaks on the underparts. Whether two forms are found or whether this is individual variation cannot at present be determined for lack of further specimens from the Yomas. *Canicapillus* was described from Arakan and Robinson and Kloss have stated, no doubt on good grounds, that the type came from Ramree Island.

Dinopium javanense intermedium (Blyth)

One from Minidaung, just north of Taungup, Sandoway is practically a topotype (type locality, Arakan; restricted by Robinson and Kloss to Ramree Island) ♂ W. 147. B. 32 from base.

Chrysocolaptes guttacristatus guttacristatus (Tickell).

Four: Ma-i and Yahu Chaung, Sandoway (100 ft.) and Nyaungchidauk, Prome (300 ft.). ♂ W. 170, B. 54; 3 ♀♀ W. 164, 168, 177, B. 48-52 mm.

Macropicus javensis crawfurdi. (Gray).

A male, Yin Chaung, Mindon Yoma foothills, Thayetmyo. W. 208, B. 51 from base.

In vol. vii of the *Fauna* ed. ii, p. 319, the name of this bird is altered to *M. crawfurdi crawfurdi* because *Picus javanensis* Horsf. is said to be preoccupied by *Picus javanensis* of Ljungh, and so *crawfurdi* is used as the specific name and *crawfurdi leucogaster* as the name of the Malay bird. In the first place this could be correct as the name *leucogaster* was given in 1826 and *crawfurdi* in 1829. In the second place, however, Horsfield (Trans. Lin. Soc., vol. xiii, p. 175, 1821) did not call this bird *Picus javanensis*, but *Picus javensis*.

The Recommendation in article 36 of the International Rules of Zoological Nomenclature states that 'if from the radical of a geographic name two or more adjectives are derived, it is not advisable to use more than one of them as specific name in the same genus, *but if once introduced they are not to be rejected on this account*.' Therefore, *Picus javensis* of Horsfield is *not* invalidated by *Picus javanensis* Ljungh and the name for the Javan bird becomes *Macropicus javensis javensis*.

Sasia ochracea reichenowi Hesse.

One from Ngapali (sea-level), Sandoway.

Jynx torquilla intermedia. Stegm.

In *Jynx t. japonica* the underparts are yellower and more barred than in *torquilla* so that the distinction between the colouration of the throat and rest of the underparts is less. In this respect these Burmese birds resemble *japonica*, but on the upper parts they are paler and greyer than is *japonica*. Moreover *japonica* from Japan is a smaller bird: W. 78.5-85 (12 measured) whereas these Burmese birds measure W. 87, 88. They should, I think, be called *intermedia*. Mr. Villar obtained two from Hman, Mindon Yoma foothills, Thayetmyo 400 ft. on January 22.

Thereiceryx lineatus hodgsoni (Bp.).

Two females: Thayetmyo foothills. W. 134, 139.
Large series: Nepal, Bhutan and Buxa Duars. ♂♀ W. 119-139.
Large series: Southern Shan and Tenasserim. ♂♀ W. 119-135.

Intermedius was described from Pahpoon, Tenasserim, but it seems that birds from this area are of the same size as Himalayan ones. Further south, in S.-W. and Peninsular Siam, Robinson and Kloss give measurements of a series as W. 118-128 and it appears possible that it is this form which needs a name.

Cyanops asiatica asiatica (Lath.).

Three from Mindon Yoma (3,000 ft.), and from the lower hills (500 ft.) on each side of it. W. 104-109.

Xantholæma hæmacephala indica (Lath.).

One: Gamon Chaung, Sandoway (500 ft.).

Eudynamys scolopaceus malayanus. (Cat. & Hume.).

Two males; Sabyin and Ngapali (sea-level), Sandoway. W. 199, 211.

Rhopodytes tristis longicaudatus (Blyth).

Two females; Sadon Chaung (300 ft.), Thayetmyo, W. 175; Ngapali, Sandoway, W. 156. The former is long in the wing for *longicaudatus* but it has the grey, not ochraceous, wash on the breast, as in that race.

Centropus sinensis intermedia (Hume).

Two from the foothills on the Thayetmyo side, W. ♂ 193; ♀ 206.

Psittacula eupatria indoburmanica (Hume).

One; Monda, Thayetmyo.

Psittacula himalayana finschii (Hume).

Two males; Mindon Yoma Reserve (1,300-1,700 ft.). W. 153, 156, T. 247, 251.

Psittacula alexandri fasciata (Müll.).

Nine specimens; from the lower hills on both sides of the Yomas in Thayetmyo, Kyaukpyu and Sandoway (50-1,600 ft.).

Muller gave this name, *fasciatus*, to the bird depicted in the *Planches Enlum.* pl. 517 and there called the 'Perruche de Pondicherry'; Muller gives no locality. In the *Fauna* (ed. ii), Pondicherry is given as the type locality. As this bird does not occur anywhere near there, Pondicherry cannot be accepted. I fix the type locality of *Psittacula fasciata* as Arakan.

Coryllis vernalis vernalis (Sparr.).

Three; Ma-i, Sandoway (50 ft.).

Coracias benghalensis affinis McClell.

One; Ma-i, Sandoway.

Merops orientalis burmanus Neum.

One; Sadon Chaung, Thayetmyo (300 ft.).

Merops erythrocephalus erythrocephalus Gm.

Three; Mindon Yoma (3,000 ft.) and Hpaukyin near Taungup, Sandoway (50 ft.).

The genus *Melittophagus* for this species seems unnecessary. The only distinction seems to be that the central tail feathers do not extend beyond the others. But in shape they are pointed in comparison with the rest of the tail. In the juvenile plumage of other members of *Merops* the central tail feathers are not elongated, and in the adults the elongation varies very much e.g. from 15 mm. in some *M. apiaster* to 80 in some *M. orientalis.* It is all a question of degree; it seems absurd to put two birds with a difference of 65 mm. in this measurement in one genus and separate into two genera two species with only 15 mm. difference.

Alcemerops athertoni (Jerd. & Selby).

One from the crest of the Yomas (3,000 ft.) on the Taungup Road. I cannot separate Burmese birds in any way from those of S. India.

Alcedo atthis bengalensis Gm.

Four: from foothill streams in Thayetmyo and Prome districts.

Ramphalcyon capensis burmanica (Sharpe).

Two: from Yin Chaung, Mindon, Yoma Reserve (400 ft.).

Halcyon smyrnensis fusca (Bodd.).

Two: from foothills, Thayetmyo.

Halcyon pileata (Bodd.).

One: from Ngapali, sea coast of Sandoway.

Sauropatis chloris armstrongi Hume.

One; from Ngapali. Mr. Baker refers all Burmese birds and those from Siam, Malay States, etc. to the typical form whereas Robinson and Kloss recognise a northern form *armstrongi* (Siam) and a southern form *humii* (Selangor). At present I maintain *armstrongi* as distinct from the typical race on the smaller wing length, as pointed out by Oherholser (Proc. U. S. Nat. Mus., vol. lv, p. 373).

Hydrocissa malabarica leucogastra (Blyth).

One; near Taungup, Sandoway (500 ft.) and a juvenile from Thani Chaung Reserve in the foothills, Thayetmyo, on January 9th.

Juvenile. A dull edition of the adult with but little gloss on the black parts of the plumage. Area round eyes and sides of chin bare as in adults. Casque smaller and of different shape. Tail feathers narrower. Black marks on casque not so extensive. As regards *malabaricus*, it is stated in the *Fauna* ed. ii, that the casque begins to grow when the bird is about 8 months old. I think this can hardly be correct. This juvenile is still in its unmoulted juvenile dress and yet the casque is about 28 mm. high or more than half the height of that of the adult and it seems highly improbable that it has held its juvenile plumage for 8 months. This is a point that field-naturalists in India and Burma might well be able to elucidate.[1]

Upupa epops orientalis Baker.

One; in the foothills, Thayetmyo. Seems to belong to this race (♀ W. 126.5, B. 48.5), but the difficulty in working out these races of Hoopoes is always accentuated by lack of *properly sexed breeding birds* from both India and Burma.

Harpactes erythrocephalus erythrocephalus Gould.

Three; from low elevations to sea coast in Sandoway, and Nyaungchidauk, Prome (200 ft.).

Harpactes oreskios uniformis (Rob.).

One; from Ngapali, sea coast, Sandoway.

Caprimulgus macrourus ambiguus Hart.

One; Gamon Chaung, Kyaukpyu boundary (1,200 ft.).

Ketupa zeylonensis leschenaulti (Tenum.).

One; from Ma-i, Sandoway. ♂ W. 405.

Glaucudium cuculoides rufescens (Baker).

Four; from Ma-i and Zani, Sandoway.

The collector notes that this Owl was much commoner in the west than the east side of the Yomas.

This race varies very much in the rufescence of the plumage and though typical birds are easily separable, there occur others in its range which are only very slightly more rufescent than is *cuculoides*. Such birds are the usual type to be found in Arakan, as I have indicated before (*J.B.N.H.S.*, xxxv, p. 38), and all six from that locality and Prome are exactly alike. *Fulvescens* from Tenasserim does not seem separable from *bruegeli* from Bangkok.

Circus melanoleucus (Penn.).

One; Lamu, Sandoway.

Astur badius poliopsis (Hume).

One; Thani Chaung Reserve, Prome.

Crocopus phœnicopterus viridifrons (Blyth).

Two; from foothills, Thayetmyo; feeding on fruits of *Zizyphus jujuba.*

Dendrophassa pompadora phayrei (Blyth).

Three; from Sandoway from 50 ft. to the crest of the Yomas.

Treron curvirostra nepalensis (Hodgs.).

Three; from Sandoway up to 1,000 ft.

These last two species are so very alike in plumage that probably sportsmen often confuse them. They can be readily differentiated by the following points:—*phayrei* lacks the white on the vent and short under tail coverts, and the yellow-green of the face extends above the eye, which part in *nepalensis* is bare.

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[1] Vide Misc. Note, by E. P. Gee, *J.B.N.H.S.*, vol. xxxvi, p. 750—Eds.

Sphenocercus sphenurus sphenurus (Gould.).

Two; from Ma-i, Sandoway and Mindon Yoma, 3,000 ft.

Muscadivora œnea sylvatica (Tickell).

One; Lamu Reserve, Sandoway (100 ft.); had fed on fruit of *Terminalia chebula;* and one near Nyaungchidauk, Prome (100 ft.).

Streptopelia chinensis tigrina (Temm. & Knip.).

One; from the foothills, Thayetmyo.

Polyplectron bicalcaratum bicalcaratum (L.).

One; from Mindon, Yoma Reserve (2,750 ft.).

Gennæus lineatus oatesi Grant.

A male and two females from Taungup-Prome road (1,500-2,900 ft.) on the Sandoway side and on the crest of the Yomas; a female from Mindon Yoma Reserve, Thayetmyo (2,750 ft.).

These are topotypes of *G. lineatus oatesi.* In the *Fauna*, ed. ii, vol. v, the type locality is given as Prome and in vol. vii it is given as Prome, Arakan Hills. This is a little confusing as Prome is not in the Arakan Hills and the Lineated Pheasant which occurs near Prome on the east side of the Irrawaddy is *G. lineatus lineatus.* The locality should have been given at lat. 19°, Arakan Hills, Prome Division. The types almost certainly came from the vicinity of the Taungup-Prome cart-road, which was then and still is the only route up into the Yomas at approximately lat. 19°. A male and a female from Oates' collection, the latter the type of *oatesi,* are available for examination. The male collected by Mr. Villar is identical with Oates' and differs from *lineatus* in the slightly coarser black markings on the upper parts, the far less white streaking on the sides of the breast and flanks, and more (black) vermiculation on the outer webs of the central tail feathers. So far as can be judged from this meagre material the males are stable.

I may here remark that *Gennaeus lineatus* Vigors was said to have come from the Straits of Malacca; this must be an error and due to the vagueness of localities given at that period. I, therefore, fix the type locality as the East Pegu Hills.

When we turn to the females we find not one of the three is alike. The general scheme of the upper parts is the same but the colouration is noticeably different; in one this is bay (Ridgway pl. ii); in another Saccardo umber (l.c., pl. xxix) and in the third the colour is intermediate between these two. The tails are still more strikingly different; their general colour partakes of the rest of the plumage; in the bay-coloured bird the tail is bay very faintly mottled with dark brown or black on the outer webs, more decidedly so on the inner webs; in the second bird the tail is also bay coloured except the centrals which partake of the colour of the upper parts; the mottling is rather decided. In the intermediate the general colour is as in the second but the mottling very heavy. On the underparts the whitish streaking is much heavier in the intermediate bird. I have gone rather into detail over these three birds as the two extremes were collected in almost the same spot and marked as near laying and, in absence of any proof to the contrary, one must suppose they all belong to the same race and it shows what very considerable allowance must be made for individual variation in *Gennaeus*, a point overlooked apparently by those in the past who have named no less than 24 species of this genus from Burma alone! Tails of the three females vary from 201-234 mm.

May I appeal once more to sportsmen and naturalists to send me even rough skins of Silver and Kalij Pheasants from any parts of Burma, with a note on the leg colouration and locality of each specimen? The question of the variation in these Pheasants is a very difficult one and also very interesting, but no progress can be made without more specimens.

Arborophila rufogularis intermedia (Blyth).

Three males and four females from the Mindon-Yoma Reserve at 2,750 ft. in heavy 'Gayin' jungle (*Melocanna bambuscides*) and at 4,200 ft. on the crest in heavy evergreen jungle. This excellent series of topotypes are very constant in colour. I have compared these with all the Manipur birds in the British Museum and many thence are much more rufous above and the chestnut colour of the scapulars and coverts occupies more of each feather giving the whole a more rufous, less olive appearance. However at the same place, Aimole in Manipur, we find more rufous and more olive-coloured birds side by side, the latter exactly matching Arakan examples.

These birds were usually in pairs or two pairs together; they are industrious workers, scratching deep holes in the ground to get food. In damp or wet weather they get up into trees, call frequently but are very hard to see.

Turnix suscitator pallescens Rob. & Baker.

Turnix maculatus maculatus Vieill.

One of each from Kyangin Reserve, Henzada (200 ft.).

Charadrius dubius dubius Scop.

One; Ma-i, Sandoway, February 19, in winter dress.

Charadrius dubius jerdoni. Jerdoni.

Two; Mindon Chaung, Thayetmyo, January 26 in breeding dress.

Hoplopterus duvaucellii (Less.).

One; Dabongyi, Thayetmyo.

Tringa hypoleucos. L.

Ngapali, Sandoway; one in complete moult with two outer primaries old, on March 3, another same date in worn plumage, but with wings newly moulted, except the outer two primaries.

Tringa ochropus. L.

One; Chayauk Chaung, Thayetmyo.

Tringa glareola. L.

One; Ma-i, Sandoway.

Glottis nebularia (Gunn.).

One; Hala Chaung, Thayetmyo; some body moult on January 21.

Dissoura episcopus episcopus. (Bodd.).

One; near Lamu Reserve, Sandoway.

Anastomus oscitans. (Bodd.).

One; Kyangin Reserve, Henzada.

In the *Fauna* ed. I, iv, p. 377 footnote, doubt seems to be cast on the supposition that the gap between the upper and lower mandibles is caused by wear. In this specimen both upper and lower mandibles are exceedingly worn, but only in the region of the gap; in the upper mandible the wear is so great that the outer horny layer is completely worn through. This bird was undergoing a complete moult of wings (March 26).

Egretta intermedia. (Wagler).

One; Yonywa, Sandoway. Apparently not recorded from Arakan previously.

Butorides striatus connectens Strese.

Two males from low ground, Thayetmyo and Sandoway. W. 180, 192. The Indian, Burmese and Indo-Chinese birds appear to be intermediate between *striatus* and *javanicus; abbotti* is a synonym of *connectens*.

Ixobrychus cinnamomeus (Gm.)

One; Thani Chaung, Prome; had been killed by a Shikra.

NOTES ON THE FOODPLANTS OF INDIAN HAWKMOTHS

BY

Lt.-Col. F. B. Scott, I.A., F.E.S.

The Rev. Miles Moss, in a paper on the Hawkmoths of South America, remarked that he found a very close connection there between Hawkmoths and the plants on which their caterpillars fed, so much so, that having found the caterpillars of a certain species feeding on a certain plant, he confidently expected to find caterpillars of closely allied species feeding on the same, or on closely allied plants.

It may be of interest to examine the foodplants of Indian Hawkmoths to see if there is evidence of a similar close connection in India.

There are one hundred and eighty-one species of Hawkmoths (family *Sphingidae*) known to occur in the limits of the Indian Empire, including Burma, and Ceylon. Information regarding the foodplants of these 181 species which has been published up to now is very scanty, and if we were dependent on the published information no conclusions could possibly be drawn, but my friend T. R. Bell, late of the Forest Department and myself have now bred and kept a record of the foodplants of nearly one hundred species. The foodplants of twenty-two more Indian species, which extend to South China, have been recorded by Rudolph Mell in his *Biologie und Systematik der Südchinesischen Sphingiden* (1922), and it is fairly safe to assume that these twenty-two species feed on the same, or on closely allied plants in both areas. Information collected from other sources brings the total number of species of which one or more of the foodplants are known, up to one hundred and twenty-four, those of the remaining fifty-seven species being unknown. This gives us enough data to examine the question.

The foodplants of the one hundred and twenty-four species cover a very wide range botanically, as they belong to no less than fifty-eight Orders of plants, extending from the Order *Dilleniaceae* (ii) to *Gramineae* (clxxiii), that is, a range of one hundred and seventy-two Orders comprising many thousands of species. In order to show the relationship between the genera of Hawkmoths *inter se,* the number of each Indian genus, in the order in which they appear in *A Revision of the Lepidopterous Family* SPHINGADAE, NOVIATES ZOOLOGICAE, Vol. ix, *Supplement* (1903) by Rothschild and Jordan, has been entered against each, and the number of each Order of plants, as given in Hooker's *Flora of British India* has been entered against each Order, to show the relationship *inter se* of the plants. These numbers will indicate at a glance the closeness or otherwise of the relationship between the different genera of Hawkmoths and of the different Orders of plants.

Caterpillars of the genus *Clanis* (14) appear to feed exclusively on plants of the Order *Leguminoseae* (l). Four out of the five species of this genus which occur in India have been found to feed on plants of this Order. Here, as in South America, we may confidently expect to find the fifth species feeding on a leguminous plant. Caterpillars of the three species of the genus *Sataspes* (33) which occur in India have also been found only on plants of the same Order. Two of the three species of the genus *Haemorrhagia* (31) feed on *Caprifoliaceae* (lxxiv) and on the closely allied Order *Rubiaceae* (lxxv), and the third species may be expected to be found feeding on one of these two Orders. The two species of the genus *Cephonodes* (32) which is closely allied to *Haemorrhagia* (31), feed entirely on *Rubiaceae* (lxxv). The five genera *Cizara* (45), *Gurelca* (47), *Sphingonaepiopsis* (48), *Rhodosoma* (50) and *Rhopalopsyche* (52), which, as may be seen from the numbers are closely allied, all feed only on *Rubiaceae* (lxxv), and thirteen species of the genus *Macroglossum* (51), closely allied to the above, also feed on plants of this Order, though other species of the genus feed on widely separated Orders. The two species of *Polyptychus* (16) feed only on *Boragineae* (c). The genera *Cypa* (24), *Smerinthulus* (25), and *Degmaptera* (26), all closely allied, feed only on *Cupuliferae* (cxl). The two species of *Leucophlebia* (15) are found only on *Gramineae* (clxxiii). In these cases a very close connection may be seen between closely allied species or genera of Hawkmoths and the plants on which their caterpillars feed, and a less close connection may be seen in the case of some other genera.

In the genus *Acherontia* (3) for instance, the two Indian species have common foodplants of the Orders *Leguminoseae* (l), *Solanaceae* (cii) *Verbenaceae* (cxi) and *Labiateae* (cxii), but each of the species has foodplants of other Orders which are not common to both. Some of the caterpillars of each of the genera *Pergesa* (54), *Hippotion* (55), *Theretra* (56), *Rhagastis* (58) and *Cechenena* (59) feed on *Geraniaceae* (xxxii), *Ampelideae* (xliii) and *Aroideae* (clxvi) but they and other species of these genera feed also on plants of many other Orders, and the same applies to *Ampelophaga* (37), *Acosmeryx* (40), *Theretra* (56) and *Cechenena* (58), which feed on both *Ternstroemiaceae* (xxiv) and *Ampelideae* (xliii).

The cases where little or no connection is apparent are more numerous. There are three Indian species of the genus *Meganoton* (4). One species feeds on *Anonaceae* (iv), but we must jump to *Verbenaceae* (cxi) for the foodplants of the second species, and to *Laurineae* (cxxviii) for that of the third. There is thus a gap of one hundred and seven Orders of plants between the foodplants of the first two species, and of seventeen between the second and the third. There are fourteen Indian species of the genus *Theretra* (56), the foodplants of eleven of which are known. These eleven species feed on plants belonging to no less than nineteen Orders ranging from *Dilleniaceae* (ii) to *Aroideae* (clxvi), an immense range. The finding of a *Theretra* caterpillar on a plant of one of these Orders would not help one much in searching for those of others of the genus, or of those of allied genera.

There are two Indian species of the genus *Rhodoprasina* (20).

One of these feeds on *Sapindaceae* (xliv) while the other feeds on *Cupuliferae* (cxl), a hundred Orders intervening. It must be remembered that each Order of plants has a large number of species, and that the number of species of plants separating the two foodplants would run into thousands. The genera *Oxyambulyx* (13) and *Marumba* (17), with the foodplants of seven of their species known in each case, range over ten Orders of plants each. *Acherontai* (3) and *Hippotion* (55), the former with two and the latter with five Indian species, also range over ten Orders, widely separated in the botanical scale, in each case. Many more instances of a similar nature might be quoted, but enough have been given to show that closely allied species and genera frequently feed on widely separated Orders of plants.

There are also many examples of widely separated genera of Hawkmoths selecting plants of the same Order or even of the same species, for their food. Two *Marumba* (17) and a *Theretra* (55) select plants of the Order *Malvaceae* (xxvi) for their food. The Order *Tiliaceae* (xxvii) provides food for an *Oxyambulyx* (13), two *Marumba* (17), an *Agnosia* (22), a *Macroglossum* (51) and a *Theretra* (55). The Order *Rosaceae* (li) is selected by a *Marumba* (17), a *Langia* (19), a *Macroglossum* (51) and a *Celerio* (53). An *Acherontia* (3) and two *Theretra* (55) feed on plants of the Order *Myrtaceae* (lix). One plant of the Order *Pedalineae* (cvii) provides food for one *Acherontia* (3) and one *Hippotion* (50). It is clear that except for a dozen genera it would not be safe to predict the foodplant of any Indian Hawkmoth from a knowledge of those of allied genera or species.

Mention has been made above of five genera of Hawkmoths sharing three Orders of plants for their food, and this raises the interesting question as to why certain Orders or species of plants are selected by the moths as foodplants for their caterpillars. What quality is there in the leaves of certain plants which make them alone suitable as food for the caterpillars of certain species? Further research is necessary before this question can be settled beyond any doubt. We can only collect information by breeding as many species as possible, and record it for the use of some genius who with microscope, chemical reagents and what not, may find the true solution. Some of the species of five genera feed on *Geraniaceae* (xxxii), *Ampelideae* (xliii) and *Aroideae* (clxvi), and another genus selects *Ampelideae* and *Aroideac* for its food. What is the connecting link betwen *Geraniaceae* (balsams), *Ampelideae* (vines) and *Aroideae* (arums) which causes the moths of five or six genera to pick them out and their caterpillars to feed on them, starving in the midst of plenty if given the leaves of the plants of the numerous Orders in between? The moths do not feed on the flowers of the selected plants. They suck the honey from the flowers of the petunia, plumbago, phlox and other plants which do not form the food of any Hawkmoth caterpillar, and many of them do not feed at all, so no connecting link can be found there. One might suspect that the botanist's arrangement of the Orders is wrong, and that the Hawkmoth is a better botanist than the professor, but even the layman can appreciate the difference between the balsam, the grape vine and the cockoo-pint. Again, if we doubt the botanist's classification, we should have to place the Orders *Sapindaceae* (xliv) and *Cupuliferae* (cxl) together, to account for the predilection of the two species of *Rhodosoma*, and make many equally impossible adjustments. Further, we should be at a loss to account for the fact that five widely separated genera select plants of the Order *Tiliaceae* (xxvii) for their food, and that the Order *Leguminoseae* (l) provides for seven widely separated genera. The one species of *Herse* (1) feeds on *Leguminoseae* (l), *Compositae* (lxxviii) and *Convolvulaceae* (ci). It is the only species of Hawkmoth which is known to feed on the Order *Compositae*. The one species of *Psilogramma* (5) feeds on four Orders of plants, ranging from *Sabiaceae* (xlv) to *Verbenaceae* (cxi). One of the two species of *Pseudodolbina* (8) has selected plants of the Order *Acanthaceae* (cix) for its food, and it is the only species known to feed on plants of this Order. The one species of *Dolbina* (11) feeds on *Oleaceae* (xcii), which it shares with *Acherontia* (3) and *Psilogramma* (5). The one species of *Compsogene* (12) feeds on *Guttiferae* (xxiii) and *Anacardiaceae* (xliv), sharing the latter foodplant with four *Oxyambulyx* (13). The one species of *Daphnusa* (18) feeds on *Sapindaceae* (xliv), which it shares with one *Marumba* (17), one *Macroglossum* (51) and one *Celerio* (53). Two species of *Deilephila* are confined to the Order *Apocynaceae* (xciv), which they share with *Nephele* (46); a second species feeds on *Rubiaceae* (lxxv) and a third on *Cornaceae* (lxxii). Most of the species of *Rhagastis* (58) feeds on *Ampelideae* (xliii) and *Aroideae* (clxvi), but one species breaks away from the rest and feeds on *Saxifragaceae* (lii).

In the numerous examples given above there is evidence here and there of some method in the selection of foodplants by the moths, and but for this evidence we should be driven to believe that the selection had been made entirely haphazard. Some further evidence of method in selection is however afforded by the preference shown for certain Orders. No less than thirty-four species belonging to thirteen genera feed on plants of the Order *Rubiaceae* (lxxv), twenty-six belonging to eleven genera on *Ampelideae* (xliii), fifteen species on AROIDEAE (clxvi) and thirteen species on *Leguminoseae* (l). On the other hand there are no less than nineteen Orders on which only one species feeds.

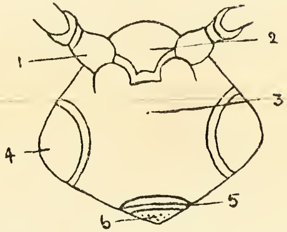
Up to now only Orders of plants have been mentioned. It does not follow that if a caterpillar will feed on one species of an Order that the other species will be equally acceptable. This is, in fact, very far from being the case. Only a few species of each Order are selected as foodplants. The Order *Leguminoseae* is a very large one, with over eight hundred Indian species, but only twenty-one of these form the foodplant of any Hawkmoth, many common species being refused by caterpillars which feed on other plants of the Order. Only thirty-five species of the Order *Rubiaceae*, with over six hundred Indian species are accepted. Of the large Order *Compositae*, with hundreds of Indian species, only two are known to form the foodplant of any Hawkmoth. There are sixteen Orders of plants, all with many species, of which only one species is accepted in each case. An examination of the species selected within each Order reveals the same result as in the case of the Orders themselves. Sometimes closely related and sometimes widely separated species are chosen. Some of the species selected as foodplants seem very curious. In the Order *Loganiaceae* the leaves of the deadly strychnine-tree are eaten by four species of Hawkmoths. In the Order *Solanaceae* the poisonous *datura* is eaten, as well as the potato, brinjal and tobacco. The spurges and arums, poisonous to mammals, are eaten by many species. The foetid smelling leaves of *Paederia foetida* are eaten by some species as readily as those of sweet smelling species by others.

From observations made in the field it appears that the selection of certain plants, haphazard or otherwise, having once been made, the moths keep most faithfully to their choice. An egg of some common and prolific species may occasionally be found on a blade of grass growing close to the leaves of the true foodplant, but generally the eggs are deposited with the utmost certainty on the proper leaves. Some of the daylight-flying species may be watched, first darting about, then hovering over a tangled mass of herbage and daintily manoeuvring for position to deposit an egg, while still hovering, on a leaf or twig of the chosen plant. We do not know how it picks out the leaves of its foodplant from all the surrounding leaves, but it seldom makes a mistake. This is another problem which further investigation may solve.

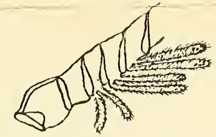
The distribution of Hawkmoths, and the number of individuals of any species occurring in any locality, is intimately connected with their choice of foodplants, and by the distribution of those foodplants. The moths themselves, being fast and powerful flyers, may be found at some distance beyond the range of their foodplants, but they can only maintain themselves and reproduce their kind in areas where at least one of their foodplants grows. The choice of their foodplants is thus a very important factor, affecting their very existence in any locality. The disappearance of a plant may cause the disappearance of a species of Hawkmoth, and the spreading of a plant, by natural or artificial means, may cause another species to extend its range. Certain species feed on plants which are grown as crops, and occur in great numbers wherever it is cultivated. One species feeds on apple and pear, and finds its way to newly started orchards, thus extending its range. There is some evidence to show that vigorous species are willing to adopt a new foodplant, and this may lead to an extension of their range or to a local increase in numbers. One species of *Rhagastis* feeds on the hydrangea in Shillong. It must have adopted the hydrangea as its food after this plant had been artificially introduced into the gardens there. It is a hardy species, and neither its egg nor its larva appears to be attacked by any parasites, and it has thriven and multiplied exceedingly. Thousands of its caterpillars are destroyed every year by indignant *malis;* many more are killed by ants when they are on the ground looking for fresh bushes to attack or when about to pupate; but it swarms in apparently undiminished numbers each season. The moth has become one of the most common of the Hawkmoths locally, but away from the station of Shillong it is rarely found. Rudolph Mell has found the same species feeding on a closely allied plant in South China. The walnut, Order *Juglandeae*, is another plant which has been artificially introduced into Shillong, and a species of *Oxyambulyx,* which feeds on a tree of the closely allied Order *Myricaceae*, has adopted the walnut also as one of its foodplants. The lantana has been introduced into India comparatively recently, and one of the *Acherontia*, which feeds on other plants of the same Order, has adopted it also, and other similar cases might be quoted.

The range of any species of Hawkmoth is by no means coincident with that of its foodplant or plants. While some of the common species may be found wherever any of their foodplants are available to support their caterpillars, other species have a range which is far more restricted than that of their foodplants. The wild vine and the wild arum are found at suitable elevations throughout the Khasi Hills and the Himalayas, but some of the species which feed on these plants are confined to the Khasi Hills and the Eastern Himalayas, others to the Western Himalayas; some to the Khasi Hills alone. Some species are found only in very restricted areas, though their foodplants cover a wide range. One species of a genus may be common and widespread, another, closely allied and feeding on the same plant, rare and restricted.

It will be seen that there are many problems regarding the choice of foodplants by Hawkmoths, and with regard to their distribution, which require further investigation.

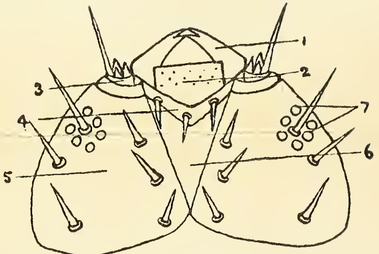


Fig—1.



Fig—2.

Fig—3.



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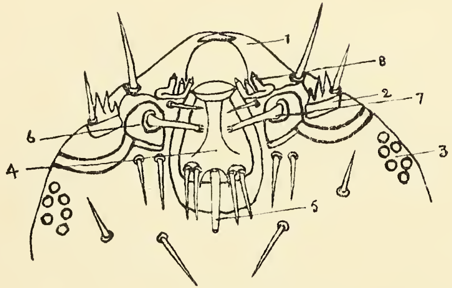

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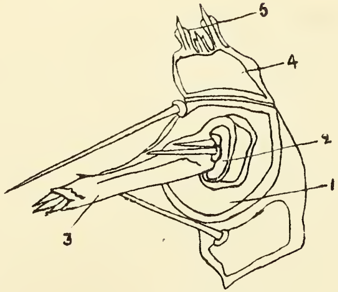

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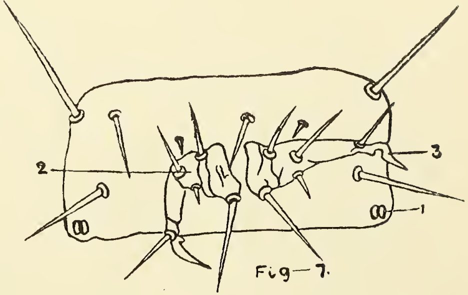

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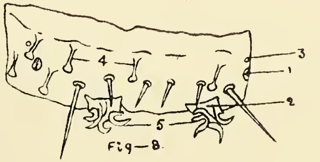

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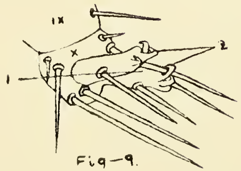

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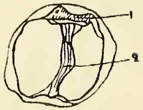
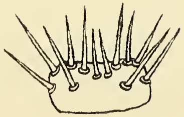
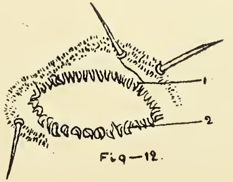


Fig—10



Fig—11.



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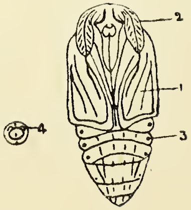

Fig—13.

For explanation of Plate see end of article.

ON THE BIOLOGY AND MORPHOLOGY OF *EPIPYROPS EURYBRACHYDIS* FLETCHER (*LEPIDOPTERA*).

(An External Parasite of *Eurybrachys tomentosa* Fb.: *Fulgoridae, Rhynchota*).

BY

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(*With one plate and a block*).

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Nearly 50 per cent of the adult females of *Eurybrachys tomentosa* collected from species of Acacia, for life-history work were found parasitised by one stage or other of the larva of *Epipyrops eurybrachydis* (*Zygaenoidea*—Lepid.). The larva was usually found underneath one of the wings of the host, holding fast to the abdominal terga, by means of the prolegs, with the head pointing posteriorly and the mouth-parts buried in the soft fatty tissue, close by the tip of the abdomen, which is covered profusely with white cottony wax, so characteristic of the female *Eurybrachys tomentosa* (Plate 1 a). The presence of the larva is always indicated by the raised position of the tegmen and the wing of one side. When the larva is only partially grown the extent to which the wing is raised is not so marked as when it is between the third and fifth instars. The fulgorid parasitised by a full-grown larva can be spotted out in its natural environment even from a distance of a few yards.

The Egg.—Each egg is about .5 mm. in length and dirty golden-yellow in colour; oval in shape. The apical end is broader and almost flat, showing a dark ring. The surface of the chorion is granular and sparsely covered with minute strands of whitish meal (Plate 2, fig. 3).

The egg hatches in 6-8 days after being laid. The larva emerges by bursting open a circular lid at the apical end of the egg.

The First Instar Caterpillar.

Length—about 1.25 mm. Body is tapering towards the posterior extremity. Head is triangular; antennae 3-jointed, the apical joint bearing minute papillae and two long sensory bristles; ocelli are six in number, circular and situated on the epicarnial plates; mandibles well developed with two pointed teeth each; maxillae long, cylindrical and three-jointed, the apical joint having minute sharp spines. The spinneret is also well developed.

Thorax.—The tergum of the prothorax is lightly chitinised and appears like a brown cross band behind the head; three sizes of minute sharply-pointed setae, apart from the more minute ones with which the body cuticle is profusely covered, are noticeable; there is a pair of prothoracic spiracles situated almost intersegmentally and a pair of stout, five-jointed legs terminating in a single curved chitinous claw, is present (Plate 2, fig. 7).

The meso and metathorax are devoid of any brown band on the terga; in addition to the sets of minute setae, noticed in the prothorax, there is seen, mostly across the middle of the ventra a row of short slightly capitate setae; two hind pairs of thoracic legs are present; spiracles are absent (Plate 2, fig. 8).

Abdomen.—There are ten abdominal segments; they are narrower towards the tip; the segments 3-4-5-6-10 bear a pair of prolegs each; the pair of the tenth segment is comparatively long and has three pairs each, of curved and sharp crochets, which are the claspers (Plate 2, fig. 9); the other prolegs are short and stumpy and bear 5-6 crochets each (Plate 2, fig. 8); the capitate setae are present on most of the abdominal ventra; the first seven segments bear a pair of spiracles each.

The posterior extremity (7-10 segments) is tinged bluish-green.

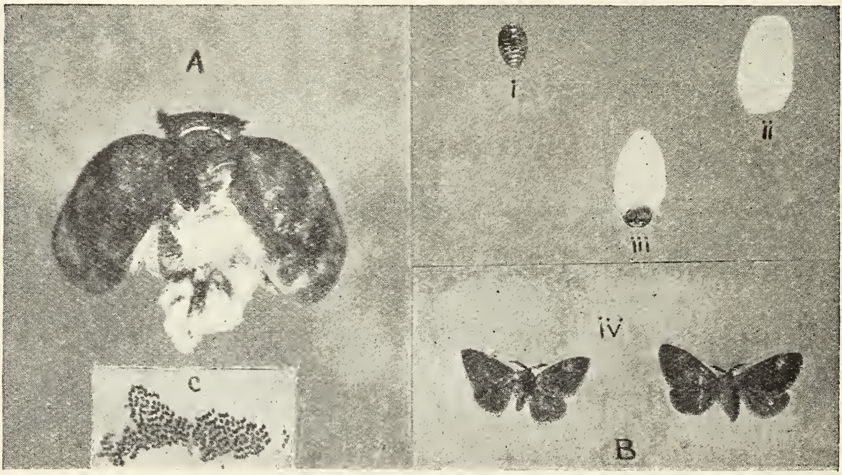
The spiracle (Plate 2, fig. 10) is of a typically lepidopterous larval kind; circular-oval, with the tips of the opening fringed with very minute, branched hairs.

The further instars of the caterpillar (2nd. *to* 5th. *instars*).

The points of difference between the first and the subsequent instars are:—

1. Marked increase in size; the full grown caterpillar measuring about 7-8 mm. long and 3-4 mm. broad at the middle.
2. The capitate setae present on some of the thoracic and abdominal segments of the first instar caterpillar are not seen.
3. Body cuticle gets much folded in 4th. and 5th. instars, so that the segmental lines are slightly obscured.
4. The wax pores (Plate 2, fig. 8) are seen in the 5 instar arranged in the first, second, third, ninth and tenth abdominal segments—a pair in each.
5. True claspers are not present, the last pair of prolegs being very short and stumpy as the others.
6. The number of crochets of prolegs increases towards the later instars and the full-grown caterpillar bears 35-38 crochets, approximating in arrangement, to the transverse uniserial type (Plate 2, fig. 12).
7. In the caterpillars of the later instars, the crochets of the posterior row are slightly longer (Plate 4, fig. 14).
8. The anal prolegs have only the anterior row of crochets.

Ecdysis of caterpillar.—For about 48 hours before the process begins, the caterpillar is quite still and does not feed. The process is undergone either on the body of the host under cover of the wings (in the later instars); or outside among the leaves (in the first instar); the caterpillar assumes a semi-doubled-up position and is fixed to the surface by means of sucker feet; later, a slit appears along the mid-ventral line from the head down to the tip of the abdomen and the emerging caterpillar slowly creeps out by a steady peristaltic movement caused by the surging of the body fluid combined with a series of contractions and relaxations of the segmental muscles; the original cuticle is gradually pushed behind, dry and much wrinkled. The whole process takes about 10-12 hours.



A. A young caterpillar sticking to the left of the abdomen of the host Fulgorid *Eurybrachys tomentosa.*
B. 1. Full-grown caterpillar.
 2. Same covered over with white cottony silk.
 3. Pupa protruding out of the cocoon.
 4. Adult moth.
C. Egg-mass of *Epipyrops eurybrachidis*.

Ecdysis occurs altogether four times, there being five instars of the caterpillar during the prepupal stage.

The full-grown caterpillar.—Length 7-8 mm. Width 3-4 mm. The head is largely oval and highly chitinised. The epicranial plates are wide and triangular, each bearing six circular ocelli near the antero-lateral margin. Above the ocelli, is the pair of three-jointed antennae.

Between the epicranial plates are the frons and the clypeus; the frons extending as far downwards as the inner posterior margins of the epicranial plates (epicranial suture), the adfrontals generally present in a lepidopterous larva, not being differentiated here. The median epicranial suture is not very prominent (Plate 2, fig. 4).

The mouth-parts of the caterpillar (fig. 5) consist of a labrum (fig. 11), a pair of mandibles, a pair of maxillae and a specialised labium with spinneret.

Mandibles are long, well developed, each having a pair of sharply-pointed teeth, which, sometimes overlap. They work like a pair of shears as in the case of mandibles of certain epidermis-feeding larvae. The sharp teeth are also pierced into the soft fatty portions of the host's body and thus the imbibing of minute quantities of the body juices is helped.

Maxillae are more or less vestigial and consist only of a broadly-cylindrical cardo and a small cuboid stipes, bearing a two-jointed palp, the tip of which is provided with sharply pointed spines. The vestiges of lacinea and galea are probably represented by the two small conical structures attached to the stipes at the outer margin. There is also present a maxillary lobe at the distal extremity consisting of a broad base with 3-4 pointed papilla-like structures (Plate 2, fig. 6).

Labium is situated on the ventral region of the head between the maxillae; it is a single, wide, lightly-chitinised structure; the submentum, mentum and prementum of a typical labium are not clearly differentiated here; the region of the submentum is broad and that of the prementum, narrow. Proximally is a long cylindrical, chitinous, median, perforated process, the spinneret hinged on to a semi-circular, chitinous framework.

Food of the caterpillar.

Fletcher (*Proceedings of the Third Entomological Meeting,* Pusa, 1919, p. 979) has hinted that 'the larva probably sucks the juices of its host'. The observation made by the writer in regard to the feeding habits of the larva, and the structural features of the mouth-parts, largely confirm that view. Several caterpillars have been noticed to feed on the soft, fatty tissues of the body of the host, specially in the neighbourhood of the lateral margins of the abdomen and also on the soft membranous parts between the pronotum, scutum, and scutellum of the thorax. Many young caterpillars have been observed, to scrape the surface of the hind margin of the tegmen of the host, in the same manner in which some caterpillars of other families scrape the epidermis of leaves, so as to leave behind only the veins; the scraped patches are to be easily distinguished from the non-scraped ones in the immediate neighbourhood. The young caterpillars have also been noted in the act of cutting the minute strands of cottony wax on the posterior margin of the abdomen of the host, perhaps, preparatory to scratching the tissue there. This sort of cutting of the cottony wax is often likely to mislead one to suppose that the caterpillar feeds on the stuff; dissecting out the digestive system of a caterpillar apparently feeding on the wax, did not reveal any of the material inside.

Some habits of the caterpillar.

The first instar caterpillar, wanders about a lot among the leaves and young twigs of the plant on which the eggs are deposited by the female moth, before it finally gets on to the body of the host Eurybrachys; a few of them have been observed to be in an upright position, clinging to the edges of leaves by means of the claspers and keep oscillating in the manner of a Geometrid larva, or a leech, presumably waiting for the host bug to pass by, in order to climb on to the latter's body. Successful finding of the host under natural conditions, before establishing there, appears to be largely a matter of chance, primarily because of the very minute size of the first instar caterpillar. In one case where 400 first instar caterpillars and half a dozen adult host bugs were present on the leaves and the twigs of a small Acacia plant in a pot, only one host bug was observed after 5 days to have been infested with three caterpillars; most of the others had died by that time. Very probably, in nature, only a very few succeed in getting on to their hosts and the majority die away; the large number of eggs laid by the female moth clearly bears out this fact; the parent makes ample provision for risks.

There appears to be no doubt, that the adult female—Eurybrachys, alone—is preferred as host, to either the male adult or the several nymphal stages of the bug. The writer has not come across a Eurybrachys nymph nor a male adult harbouring the caterpillar. Numerous female adults have been obtained infested with caterpillars of all stages of growth from the second to fifth, in different situations on the body. The last three instars have usually been found hidden beneath the wings, on one or both sides of the mid-dorsal line, with the head end pointing towards the posterior extremity, sticking fast to the surface by means of the prolegs and with mandibles buried into the fatty portions of the abdomen. The younger stages have been noted to be wandering on to the ventral surface as well as the tegmen, whose surface they go on scratching specially at the margins.

The duration of the larval period—6-6½ weeks is generally well within the life-span of the adult host. Six to seven days after the final moult the caterpillar leaves the host and selecting a suitable place on the undersurface of a twig begins to spin a cocoon round itself and then pupates. The host, dying prematurely, the caterpillar, not yet full-grown, also gradually dies away; for, the latter, does not thrive with feeding on the dead remains of the former.

The effect of the larva on the host-bug is sometimes apparent in the slow and only occasional movements of the latter (also due, in some instances, to a gravid condition). That the larva is of the nature of an external parasite of the fulgorid (somewhat like the external acarine parasites of domestic animals) there cannot be any doubt, judged specially from the habits of the former; but it cannot be anything more than a feeble external parasite. The normal life-span of the fulgorid host does not seem to be shortened by any marked degree, nor the egg laying capacity, by the parasitic habits of the larva. Two sets of female Eurybrachys, one with the larva, the other without, kept under observation under exactly similar conditions in the laboratory lived for about 7 weeks and oviposited thrice, there being 80-90 eggs each time in separate clusters covered over by white cottony meal. More than four larvae of different stages of growth have been observed on the same individual host.

Cocoon-Spinning.—The caterpillar first stations itself firmly on the surface on which the cocoon is to be spun by means of the sucker-feet. Then begins a series of back and forth and up and down movements of the head and the thorax; the spinneret situated on the ventral surface of the head, sends forth a continuous stream of tough white silk; the latter is woven, as a result of the series of movements, into a cocoon, layer over layer. The whole process occupies about three hours.

The Cocoon is of milk-white cottony silk, oval in shape and has a flat bottom by which it is firmly stuck on to the undersurface of twigs and a semi-dome-like upper. The surface is smooth except for a few shallow furrows and short blunt elevations 2-5 in number, usually along the upper middle line and rarely one or two on a side.

The Pupa is of a dark blue colour and varies in size with the sex of the adult moth into which it is transformed. The antennal and wing cases are very clearly marked, as also the region of the compound eyes of the future moth. The abdominal portion of the pupa, is pale blue and less heavily chitinised than the head and thoracic portions. Five pairs of spiracular openings are also clear on the first five abdominal segments. The abdomen has a small anal slit and two papillae (Plate 2, fig. 13).

Eclosion of the moth.—Through a transverse slit, at one end and at the point of contact, of the cocoon with the surface of the twig, the anterior heavily chitinised part of the pupa is thrust outwards and upwards; next a longitudinal slit along the mid-ventral line of the extruded portion forms the exit for the moth. With the head inside the anteriormost portion of the extended part of the pupa, acting as a pivot, the thorax, first and the abdomen, next, are slowly drawn out; the wings and legs also appear at about the same time and gradually unfurl and straighten themselves. In this condition the moth rests for some time; finally the head is extricated; with the whole body thus entirely out of the pupa, the moth rests for a second time before active movement.

The Adult moth (Plate 1 *b*).—*Epipyrops eurybrachydis* is one of 'the three most commonly-occurring species of the only Indian genus Epipyrops, of the family Epipyropidae under the super family Zygaenoidea' (Fletcher, *Proceedings of the Third Entomological Meeting*, Pusa 1919, vol. iii, p. 979).

There appears to be a marked variation in size of the different individuals of the same species, apart from the difference in size between the male and female, the latter being on the whole slightly larger.

The head is circular-oval, consisting of a narrow epicranium, a wide, deeply-sculptured fronto-clypeus occupying the greater portion and the labrum. The compound eyes are large and round.

The antenna is long, 14-16 jointed (14 joints in the male and 16 in the female as a rule) each joint having a pair of different sized lateral branches which again branch into a large number of small setae, the whole presenting the appearance of a plumouse structure.

In addition to the setae, the lateral branches have a number of sensory pits lined with extremely delicate sensillae.

A true proboscis is absent; very probably, in nature, the moth does not feed; in the laboratory, however, it was attracted by dilute honey and appeared to imbibe it in extremely small quantities. Labial palps are highly vestigial.

Wings are well developed and their expanse is greater in the female than in the male. The moths are capable of a low jerky flight. In the natural sitting position the wings are held in a steeply-sloping manner, while the body is also similarly poised; the head being farthest upwards from the surface and the first pair of legs extended. The hind part of the body is usually completely hidden.

The legs are long and slender.

The abdomen is stouter in the female than in the male. Seven abdominal segments are clearly visible.

Under laboratory conditions several moths lived from 8 to 10 days and the female began to oviposit 24-36 hours after emergence. Each female laid not less than 400-500 eggs, stuck on the leaves and twigs of Acacia sp. one of the host plants of the fulgorid. The eggs are laid in groups of irregular rows (Plate 1, *c*).

Acknowledgments.—The author desires to express his gratefulness to late Dr. K. Kunhi Kannan, Entomologist, at whose suggestion the study of this parasite was taken up and to Dr. Leslie C. Coleman, Director of Agriculture, and Mr. T. V. Subramaniam, Officiating Entomologist, who both read through the manuscript and offered several valuable suggestions.

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DETAILED EXPLANATION OF PLATE.

Fig. 1.—Head of an adult moth.
    1. Antenna. 2. Epicranium. 3. Fronto-clypeus. 4. Compound eye. 5. Labrum. 6. Epipharynx.
Fig. 2.—Portion of antenna of adult moth.
Fig. 3.—Egg.
Fig. 4.—Head of caterpillar. Dorsal view,

1. Mandible. 2. Labrum. 3. Antenna. 4. Clypeus. 5. Epicranium. 6. Front. 7. Ocelli.

Fig 5.—Head of caterpillar. Ventral view.
1. Mandible. 2. Antenna. 3. Ocelli. 4. Labrum. 5. Spinneret. 6. Maxilla. 7. Maxillary palp. 8. Maxillary lobe.

Fig. 6.—Maxilla of caterpillar.
1. Cardo. 2. Stipes. 3. Palp. 4. Maxillary lobe. 5. Papillae of maxillary lobe.

Fig. 7.—Prothorax of caterpillar. Ventral.
1. Spiracle. 2. Thoracic leg. 3. Claw.

Fig. 8.—Abdominal segment of caterpillar. Ventral.
1. Spiracle. 2. Abdominal proleg. 3. Wax pore. 4. Capitate setae. 5. Crochets.

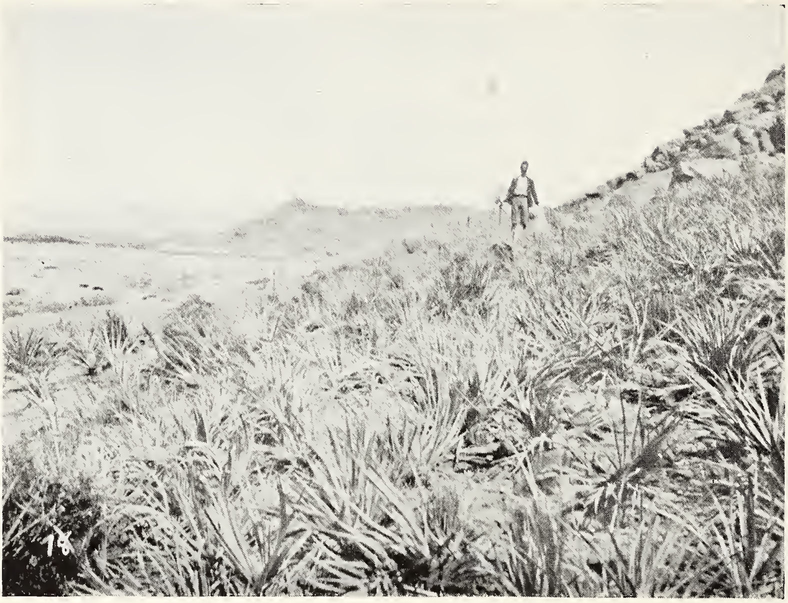
Fig. 9.—Claspers of first instar caterpillar.
1. Claspers. 2. Crochets of clasper.

Fig. 10.—Spiracle.
1. Sensory hairs lining the opening. 2. Elastic fibre to open the spiracle.

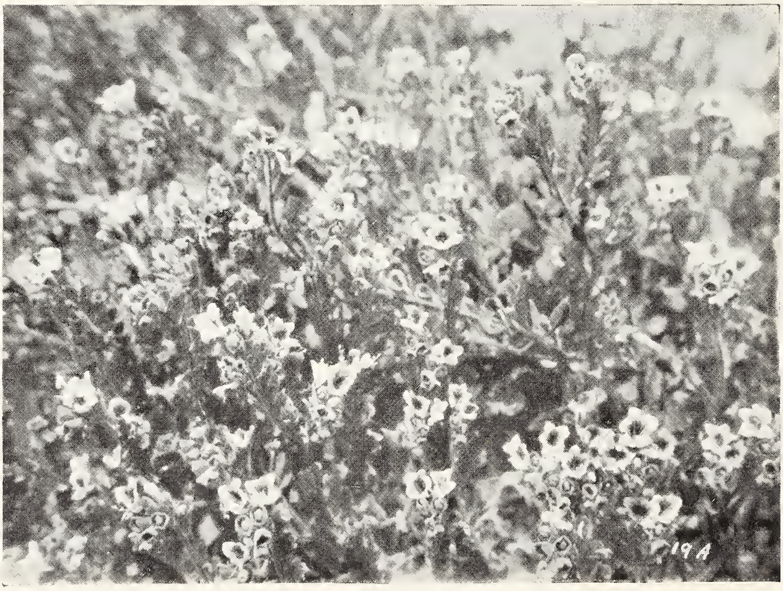
Fig. 11.—Labrum of caterpillar.

Fig. 12.—Crochets of abdominal leg.
1. Anterior crochets. 2. Posterior crochets.

Fig. 13.—Pupa.
1. Wing cover. 2. Antennal lobe. 3. Spiracle. 4. Tubercles of the tip of abdomen.



Rocky left bank of Chasmai River with *Nannorhops ritchieana* H. Wendl.



Hyoscyamus muticus L.

Photos by J. Fernandez.

THE FLORA OF WAZIRISTAN.

BY

E. BLATTER, S.J., Ph.D., F.L.S and J. FERNANDEZ.

PART II.

(*With two plates*).

(*Continued from page* 687 *of this volume*).

MALVACEAE.

700 species.—Tropical and temperate regions.

ALTHAEA (Tourn.) L.

15 species.—Temperate regions of the Old World.

Althaea Ludwigii L. Mant. (1767) 98.
Vernacular name: Nagamboti (Williams).
Locality: *N.W.*: S. of Miram Shah, gravel, 3,150 ft. (B. & F. 475 !)
S.W.: Barwand, 4,000 ft. (Duthie's Collect. 15773 !).
Tank: Near Tank (J. Williams).
Fruit: 28-3-30 (Miram Shah); 26-4-1895 (Barwand); 23-5-1891 (Tank).
Distribution: Deccan, Sind, W. Asia, Mediterranean, S. Africa.

Althaea villosa Blatter in Journ. Ind. Bot Soc. ix (1930) 201.
Locality: *N.W.*: Miram Shah along Tochi River (F. 804 !).—Miram Shah, gravel plain, 3,150 ft. (B. & F. 980 !).—Near Miram Shah, right bank of Chasmai River in cultivated fields, 3,150 ft. (B. & F. 333 !).
Flowers & Fruit: 24-3-30 (Chasmai River); April; 9-4-30 (Miram Shah).
Distribution: Endemic.

Althaea villosoides Blatter in Journ. Ind. Bot. Soc. ix (1930) 202.
Vernacular name: Chaplaverkie (Waziri).
Locality: *N.W.*: Miram Shah along Tochi River, 3,000 ft. (F. 805).
Flowers & Fruit: April.
Distribution: Endemic.

MALVA (Tourn.) L.

30 species.—N. temperate regions.

Malva sylvestris L. Sp. Pl. (1753) 969; Boiss. Fl. Or. i (1867) 819.
Vernacular name: Chota gul kharru (J. Williams).
Locality: N.W.: E. of Miram Shah Fort, 3,150 ft. (B. & F. 118 !).
Tank (J. Williams 7117 !).
Flowers: 22-3-30 (Miram Shah); 4-5-1888 (Tank).
Distribution: Orient, Mediterranean, Europe, N. Africa, Siberia.

Malva rotundifolia L. Sp. Pl. (1753) 688 (*partim*); Boiss. Fl. Or. i (1867) 820.
Vernacular name: Wahankai, Naghankai, Nahankai (Waziri).
Locality: *N.W.*: Razani, 5,000 ft. (F. 2186 ! 2575 ! 2592 ! 2735 !).—Datta Khel village, 4,600 ft. (B. & F. 1496).—Miram Shah village (B. & F. 452 !).—Bank of Chasmai River, 3,100 ft. (B. & F. 204a !).—Bed of Sua Algad (B. & F. 367 !).—N. of Dossali Fort (B. & F. 1033 !).—Above Dossali, bed of Khunai River, 5,050 ft. (B. & F. 1104 !).—W. of Spinwam Fort, gravel, 2,660 ft. (B. & F. 847 !).—Below Spinwam Fort, bed of Kaitu River (B. & F. 441 !).—Shewa Post, on Kuram River (B. & F. 936 !).
S.W.: Wana, stony plain, 4,500 ft. (F. 3483 ! 3492 !).—Razmak, open stony ground, 6,500 ft. (F. 1899 ! 1900 ! 2650 !).—Sararogha, 4,000 ft. (F. 222 !).
Flowers & Fruit: March, April, May.

Distribution: Europe, N. Africa, N. & W. Asia, Persia, Afghanistan, Baluchistan, Kuram Valley, Sind.

Malva parviflora L. Amoen. Acad. ed. 2, iii (1787) 416.
Note.—Numerus 491 *habet carpella marginibus dorsi distincte alata sinuata et semina brunnea.*
Vernacular name: Ngankai, Tikalai (Waziri).
Locality: *N.W.*: Datta Khel in stony plain, 4,500 ft. (F. 1272 ! 1312 !).—Miram Shah (F. 491 ! 831 !).
S.W.: Near Kaniguram brook (Stewart).—Razmak, 6,500 ft. (F. 1971 ! 1977 !).
Flowers & Fruit: April.
Distribution: Mediterranean region, Nubia, Arabia, Persia, Afghanistan, Baluchistan, N.W. India, Sind.
Uses: Eaten as greens.

Malva waziristanensis Blatter in Journ. Ind. Bot. Soc. ix (1930) 202.
Vernacular name: Pathivai (Waziri).
Locality: *N.W.*: Miram Shah, 3,000 ft. (F. 493 !).
Distribution: Endemic.
Uses: Eaten as a pot herb (F.).

SIDA L.

70 species.—Cosmopolitan.

Sida rhombifolia L. Sp. Pl. (1753) 684.
Locality: *S.W.*: Jandola (F. 4140 !).
Distribution: Throughout the tropics.

Sida veronicaefolia Lam. Encycl. i (1783) 5.
Locality: *N.W.*: In the plains (Stewart).
Distribution: Tropical and subtropical regions of the world.

ABUTILON Tourn.

120 species.—Tropics and subtropics.

Abutilon indicum Sweet Hort. Brit. i (1827) 54; Wight Ic. t. 12.
Locality: *N.W.*: Miram Shah, on hills, 3,000 ft. (F. 281 ! 282 ! 1382 ! 1387 !).—E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 649 !).
S.W.: Near Palosina (Stewart).
Flowers: April (Palosina).
Distribution: Spread throughout the tropical zone of the whole world.

Abutilon fruticosum Guill. Perr. & A. Rich. Fl. Senegamb. i (1830) 70; Boiss. Fl. Or. i (1867) 836.
Locality: *N.W.*: Miram Shah, open stony plain, 3,000 ft. (F. 939 ! 1456 !).—W. of Spinwam Fort, gravel plain, 2,650 ft. (B. & F. 828 ! 859 !).—E. of Miram Shah, hills, 3,600 ft. (B. & F. 5641 !).
S.W.: Sararogha, 4,000 ft. (F. 198 ! 215 !).—Jandola, stony ground, 2,200 ft. (F. 4136 !).
Tank (J. Williams 7780 !).
Flowers: 4-4-30 (Spinwam); 11-8-1888 (Tank).
Distribution: Canaries, tropical Africa, Palestine, Arabia, Sind, Baluchistan, Punjab, Ceylon.

Abutilon cornutum T. Cooke Flora Bomb. Presid. i, 98.
Locality: *N.W.*: Shewa Post, bed of Volam River (B. & F. 907 !).
Distribution: Sind.

PAVONIA Cav.

70 species.—Tropics and subtropics.

Pavonia glechomifolia Garcke in Schweinf. Beitr. Fl. Aeth. (1867) 54.
Locality: *N.W.*: Dossali Fort (B. & F. 475a !).
Fruit: 10-4-30 (Dossali).
Distribution: Gujarat, Cutch, Sind, Baluchistan, Arabia, tropical Africa.

Pavonia sp.
Locality: *S.W.*: Razmak, 6,500 ft. (F. 3242 !).

HIBISCUS L.

160 species.—Tropics and subtropics.

Hibiscus Trionum L. Sp. Pl. (1753) 697.
Locality: *S.W.*: Pre Ghal (J. Williams 7779 !).
Flowers: 8-8-1888 (Pre Ghal).
Distribution: S. Europe, tropics of the Old World.

Hibiscus sindicus Stocks in Hook. Ic. Pl. (1852) t. 802.
Locality: *Tank*: Near Tank (J. Williams 7783 !).
Fruit: 14-8-1888 (Tank).
Distribution: Sind, Baluchistan.

Hibiscus sp.
Locality: *S.W.*: Jandola, 2,200 ft., cultivated (F. 1528 ! 1529 !).

BOMBACACEAE.

140 species.—Tropical, especially American.

BOMBAX L.

60 species.—Tropics.

Bombax ceiba L. Sp. Pl. 511.
Locality: *N.W.*: Planted at Miram Shah (B. & F. !).
Flowers: March, leafless at the time.
Distribution: Throughout hotter parts of India.—Malaya.

STERCULIACEAE.

660 species.—Chiefly tropics.

MELHANIA Forsk.

45 species.—Africa, Asia, Australia.

Melhania futteyporensis Stocks ex Mast. in Hook. f. Fl. Brit. Ind. i (1874) 373.—*M. tomentosus* Stocks ex Mast. l.c.
Locality: *N.W.*: Razani (Stewart).—Miram Shah (F. 886 !).
S.W.: Spin, open stony plain (F. 3836 !).
Tank: Near Tank (J. Williams 7782 !).
Flowers: 13-8-1888 (Tank).
Distribution: Central Provinces, Punjab, Gujarat, Sind, Rajputana Desert, Trans-Indus.

Melhania sp. ?—Material too scanty.
Locality: *S.W.*: Tenai Post, open stony ground (F. 3799 !).

TILIACEAE.

380 species.—Tropical and temperate regions, chiefly S.-E. Asia and Brazil.

GREWIA L.

150 species.—Asia, Africa, Australia, especially tropical.

Grewia lævigata Vahl Symb. i (1790) 34.
Locality: *S.W.*: E. of Razmak, grassy slope of hill (B. & F. 1731 ! 1962 !).
Distribution: India, tropical Africa, Malaya, Australia.

Grewia salvifolia Heyne ex Roth Nov. Pl. Sp. (1821) 239.
Locality: *N.W.*: Dossali Fort, nala (B. & F. 1070 !).
Distribution: India (W. Peninsula), N.-W. Provinces, tropical Africa.

Grewia tenax Fiori Bos. Piant. legn. Eritrea (1909) 246; Blatter Fl. Arab. in Rec. Bot. Surv. Ind. viii, pt. 1 (1919) 88.—*Chadara tenax* Forsk. Fl. Aeg.—

Arab. (1775) p. cxiv and p. 105.—*G. populifolia* Vahl Symb. i (1790) 33.—*G. betulaefolia* Juss. in Ann. Mus. Paris iv (1804) 92, t. 4, f. 1.

Vernacular name: Shihari Mewa (Kohat).

Locality: *N.W.*: On gravel of left bank of Volam River near Shewa Post (B. & F. 877 !).—Dossali Fort, nala (B. & F. 1182 !).—Spinwam Fort, low limestone hill, 2,650 ft. (B. & F. 832 ! 833 !).

S.W.: Jandola, stony ground and nalas (F. 635 ! 727 !).

Tank: Zam Valley N.-W. of Tank (Stewart).

Flowers: 5-4-30 (Shewa Post).

Distribution: Punjab, Rajputana Desert, dry parts of Bombay and Madras Presidencies, Cutch, Sind, Baluchistan, Afghanistan, Persia, Arabia, tropical Africa, Mauritius, Ceylon.

Uses: Eaten by goats and sheep.

Grewia elastica Royle Ill. Bot. Himal. (1839) 104, t. 22.

Locality: *N.W.*: Miram Shah (F. 940 ! 941 !).

Fruit: 13-4-27 (Miram Shah).

Distribution: Sub-Himalayan tract and valleys ascending to 3,500 ft., Salt Range.

TRIUMFETTA Plum. ex L.

75 species.—Tropics.

Triumfetta rhomboidea Jacquin En. Pl. Carib. (1760) 22 *et* Select. Am. (1763) 147, t. 90.

Locality: *S.W.*: Jandola (F. 3292 !).

Fruit: 29-5-27 (Jandola).

Distribution: India, tropical Africa, Malaya, China, America.

CORCHORUS (Tourn.) L.

40 species.—Warm regions.

Corchorus depressus Stocks. in Proc. Linn. Soc. i (1848) 367.—*Antichorus depressus* L. Mant. (1767) 64.—*Corchorus antichorus* Raeusch Nom. ed. 3 (1797) 158.

Locality: *Tank* (J. Williams 7784 !).

Fruit: 12-7-1888 (Tank).

Distribution: Cutch, Kathiawar, Gujarat, Deccan, Sind, Rajputana Desert, Afghanistan, Arabia, Cape de Verde Islands, tropical Africa.

Corchorus trilocularis L. Mant. (1767) 77.

Locality: *N.W.*: E. of Spinwam Fort, sandstone nala (B. & F. 653 !).—W. of Spinwam Fort, stony plain, 2,650 ft. (B. & F. 850 !).—Shewa Post, right bank of Kuram River, 2,150 ft. (B. & F. 935 !).—Dwa Warkha (Stewart).

Fruit: 1-4-30 (Spinwam).

Distribution: Deccan, Gujarat, Rajputana, Afghanistan, tropical Africa.

LINACEAE.

150 species.—Cosmopolitan.

LINUM Tourn. ex L.

95 species.—Temperate and subtropical regions, especially Mediterranean.

Linum strictum L. Sp. Pl. (1753) 279.

Locality: *N.W.*: Dwa Warkha (Stewart).

Distribution: Punjab, W. Tibet, 10,000 ft., from Soongaria to N. Africa and Italy.

***Linum grandiflorum** Desf. **var. coccineum** Hort.

Locality: *N.W.*: Miram Shah Fort, 3,150 ft., gardens (B. & F. 629 !).

Flowers & Fruit: 31-3-30.

Distribution: Algeria.

ZYGOPHYLLACEAE.

160 species.—Tropics and subtropics xero- or halophytes.

Tribulus Tourn. ex L.

12 species.—Africa, Asia, America, Mediterranean.

Tribulus terrestris L. Sp. Pl. (1753) 387.
Locality: *N.W.*: In the plains (Stewart).—Boya, right bank of Tochi River, 3,550 ft. (B. & F. 1669 !).—Miram Shah (F. 362 !).—W. of Spinwam Fort, gravel plain, 2,650 ft. (B. & F. 844 !).—E. of Spinwam Fort, sandstone hills, 2,800 ft. (B. & F. 794 ! 814 !).
S.W.: Jandola, along Tank River (F. 663 ! 782 !).
Tank: Near Tank (J. Williams 9201 !).
Flowers & Fruit: 4-4-30 (Spinwam); 14-4-27 (Miram Shah); 21-4-30 (Boya); 25-5-27 (Jandola).
Distribution: Warmer regions of the world.

Tribulus bimucronatus Viv. Dec. Pl. Aeg. 9, t. 2, f. 4.
Vernacular name: Khaiarbita (Waziri).
Locality: *N.W.*: Miram Shah (F. 321 !).—E. of Spinwam Fort, rocky nala, 2,650 ft. (B. & F. 659 !).
Flowers & Fruit: 1-4-30 (Spinwam); 16-4-27 (Miram Shah).
Distribution: Afghanistan, Arabia, Egypt.

Tribulus macropterus Boiss. Diagn. ser. 1, i, 61.
Locality: *S.W.*: Tenai Post (F. 4031 !).
Flowers & Fruit: 21-6-27 (Tenai)
Distribution: Afghanistan Persia, Egypt.

Fagonia Tourn. ex L.

20 species.—Mediterranean, S. Africa, California, Chili.

Fagonia cretica L. Sp. Pl. (1753) 553.
Locality: *N.W.*: Razani (Stewart).
Distribution: Mediterranean, N. Africa, Arabia, Syria.

Fagonia mollis Del. Ill. Fl. d'Eg. (1813) 86, t. 28, f. 2.
Vernacular name: Spilakhzai, Sussa, Drab, Ackzikai (Waziri).
Locality: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1330 !, F. 1257 ! 1259 !).—Left bank of Dariawasti Algad near Datta Khel Fort, on rocks (B. & F. 1646 !).—Near Datta Khel village (B. & F. !).—Boya (F. 1474 !).—E. of Miram Shah Fort, gravel plain, 3,150 ft. (B. & F. 156 !).—Miram Shah (F. 994a !).—N. of Dossali Fort, stony plain, 4,900 ft. (B. & F. 1102 ! 1298 !).—Razani (F. 2127 !).
S.W.: Razmak (F. 3251 !).—Sararogha (F. 89 !).—Wana (F. 3578 !).
Flowers: 12-4-27 (Miram Shah); 15-4-30 (Dossali); 16-4-30 (Datta Khel); 19-4-30 (Dariawasti Algad); 20-4-27 (Razani).
Distribution: Egypt, Sinai.
Uses: Eaten by camels.

Fagonia Kahirina Boiss. Diag. ser. 1, viii, 122; Fl. Or. i, 905.
Vernacular name: Spelakzai (Waziri).
Locality: *N.W.*: Boya (F. 1059 !).—Miram Shah (F. 295 ! 304 !).
S.W.: Jandola, along Tank River (F. 730 !).
Flowers: 28-3-27 (Boya); 16-4-27 (Miram Shah).
Fruit: 26-5-27 (Jandola).
Distribution: Syria, Egypt, N. Africa.
Medicinal uses: The plant is crushed and boiled in water and the decoction drunk; considered to be a blood-purifier.

Fagonia Bruguieri DC. Prodr. i (1824) 704; Boiss. Fl. Or. i, 905.
Locality: *N.W.*: Miram Shah (F. 17 ! 994 !).—Miram Shah, right bank of Chasmai River, on sandy clay, 3,100 ft. (B. & F. 214 !).—E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 663 !).
S.W.: Jandola (F. 4123 !).—Spin (F. 3867 !).—Tenai (F. 3817 ! 4041 !).

Flowers & Fruit: 23-3-30 (Chasmai River); 1-4-30 (Spinwam); 12-4-27 (Miram Shah); 29-5-27 (Jandola); 21-6-27 (Tenai).
Distribution: Baluchistan, Afghanistan, Persia, Mesopotamia, Syria, Arabia, Egypt, Algeria.

Fagonia Bruguieri var. laxa Boiss. Fl. Or. i, 906.
Locality: *N.W.*: Bed of Chasmai River, 3,100 ft. (B. & F. 302 !).—W. of Spinwam Fort, Chota Darweshta, 2,700-3,000 ft. (B. & F. 715 !).
Flowers & Fruit: 24-3-30 (Chasmai River); 2-4-30 (Spinwam).
Distribution: Persia.

Fagonia arabica L. Sp. Pl. (1753) 553 (*non* Fl. Brit. Ind.).
Locality: *N.W.*: Boya (F. 927 !).—Miram Shah (F. 481 !).—Near Khajuri, left bank of Sua Algad on hill (B. & F. 395 !).
S.W.: Sararogha (F. 160 !).—Jandola (F. 652 ! 4117 !).—Sarwekai (F. 3966 !).
Flowers & Fruit: 26-3-30 (Khajuri); 12-4-27 (Miram Shah); 20-5-27 (Sararogha); 29-5-27 (Jandola); 7-6-27 (Sarwekai).
Distribution: Baluchistan, Persia, Syria, Palestine, Arabia, Egypt, Tripolitania.

Fagonia parviflora Boiss. Diag. Pl. Or. ser. 1, viii (1849) 124.
Vernacular name: Spelaczai (Waziri).
Locality: *S.W.*: Sararogha (F. 613 !).
Fruit: 16-5-27 (Sararogha).
Distribution: Persia, Egypt, Nubia, Abyssinia.

PEGANUM L.

4 species.—Mediterranean, Asia, N. America.

Peganum harmala L. Sp. Pl. (1753) 444.
Vernacular name: Spelane (Pu.); Sponda (Waziri); Spelannai (near Spinwam).
Locality: *N.W.*: Razani (Stewart, F. 2093 !).—Datta Khel (F. 1185 !).—Boya (F. 1379 ! 1479 !).—Miram Shah (F. 1404 !).—Spera Raga, N.-W. of Spinwam (Meynell !).—Sua Algad near Khajuri (B. & F. 356 !).
S.W.: Zam valley above Khirgi, frequent (Stewart).—Between Makin and Razmak (Stewart).—Razmak (F. 2710 !).—Sararogha (F. 153 ! 218 !).—Jandola (F. 650 !).—Sarwekai (F. 3897 !).—Tenai Post (F. 3809 !).—Wana (F. 3405 ! 3467 !).
Flowers: March to May.
Fruit: May to June.
Distribution: Kashmir, Punjab Plain, W. Deccan, Sind, Baluchistan, Afghanistan to Arabia, N. Africa, S. Europe.

Peganum harmala var. stenophylla Boiss. Fl. Or. i, 917.
Vernacular name: Sponda (Mashudi).
Locality: *S.W.*: Dargai Post (F. 4084 !).—Spin (F. 3864 !).
Distribution: Baluchistan, Afghanistan.

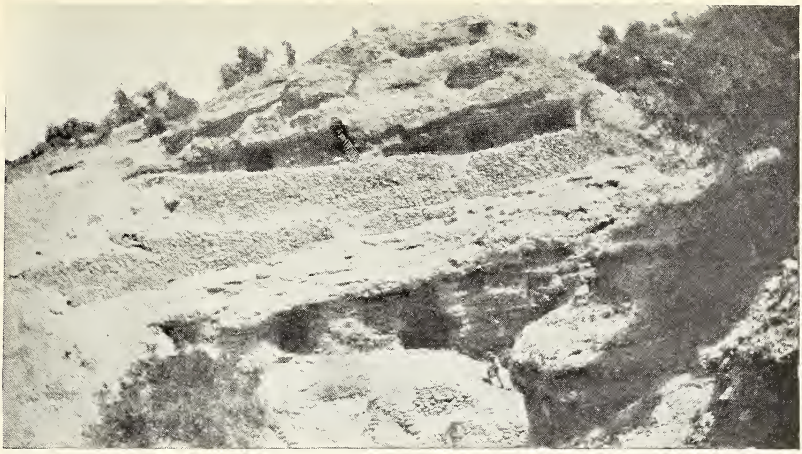
GERANIACEAE.

650 species.—Cosmopolitan.

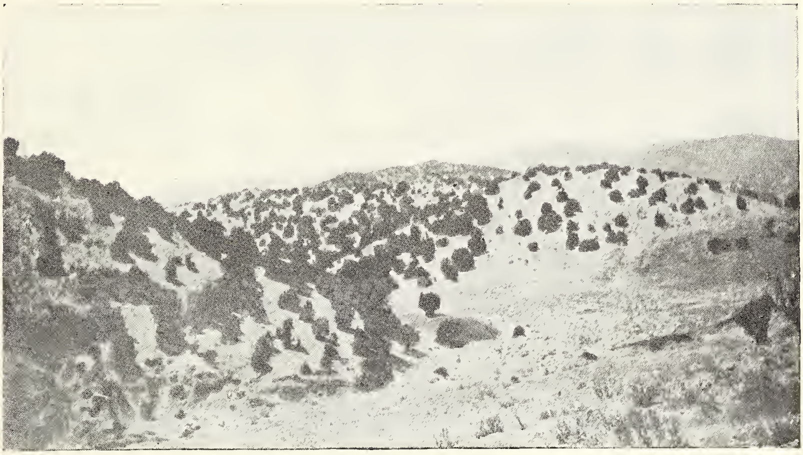
MONSONIA L.

30 species.—Africa, Asia.

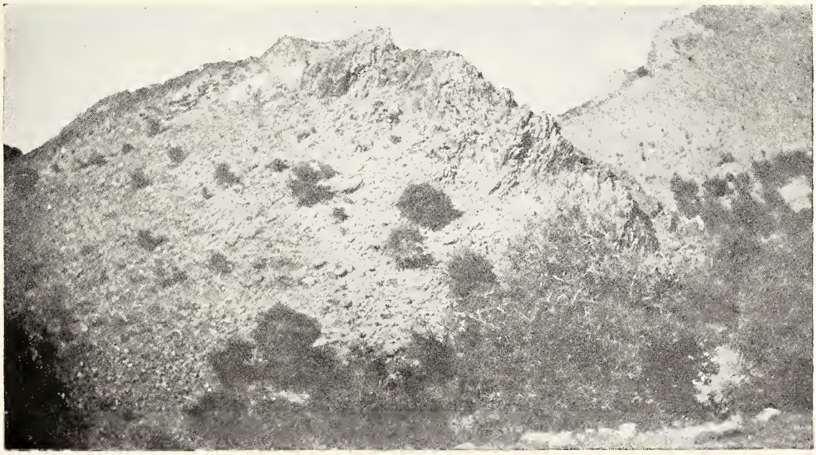
Monsonia heliotropioides (Cav.) Boiss. Fl. Or. i (1867) 897.
Locality: *N.W.*: E. of Spinwam Fort, nearest sandstone hill, 2,800 ft. (B. & F. 796 !).
Flowers & Fruit: 3-4-30.
Distribution: From Egypt and Nubia through S. Persia to the Punjab, Sind and Rajputana Desert.



Caves carved out of conglomerate in Barari Tangi above Sararogha Fort. These are inhabited in winter while in summer the people move into tents and shelter of trees.



Quercus ilex L. forming pure growth S. of Razani Camp.



S.-E. of Boya Fort. At the base *Nannorhops ritchieana* H. Wendl. Large trees of *Olea cuspidata* Wall. and *Monotheca buxifolia* Dcne. Small bushes of *Withania coagulans* Dunal.

Photos by J. Fernandez.

GERANIUM (Tourn.) L.

300 species.—Cosmopolitan, especially temperate.

Geranium rotundifolium L. Sp. Pl. (1753) 683.
Locality: *N.W.*: E. of Miram Shah Fort, slope of hills, 3,600 ft. (B. & F. 561 ! 572 !, F. 591 !).
Flowers: 29-3-30 (Miram Shah); 13-4-27 (Miram Shah).
Distribution: W. temperate Himalaya, 6,000-9,000 ft., Punjab, Afghanistan, Baluchistan, Siberia, westwards to Europe and N. Africa.

Geranium pseudo-aconitifolium Blatter *sp. nov.*—*G. aconitifolium* Edgew. & Hook. f. in Hook. f. Fl. Brit. Ind. i, 429 (*non* L'Herit).
Description in Hook. f. Brit. Ind. l.c. Vide Kunth in Engler's Pflanzenreich iv, 129 (1912) 126, *in nota.*
Locality: *S.W.*: Pre Ghal (Hay).
Distribution: W. Tibet.

Geranium nepalense Sw. Geran. i (1820-22) t. 2.
Locality: *S.W.*: To Razmak (Stewart).
Distribution: N.-W. Himalaya 5,000-9,000 ft., to Sikkim, Khasia Hills, Nilgiris, Pulneys, Ceylon, Japan.

Geranium sp.
Locality: *S.W.*: About Kaniguram (Stewart).

Geranium sp.
Radix lignosa, verticalis, 10 *cm. longa. Folia reniformia.*
Locality: *N.W.*: Low hills W. of Miram Shah Fort, between rocks, 3,300 ft. (B. & F. 12 !).

ERODIUM L'Herit.

65 species.—Temperate regions.

Erodium cicutarium L'Herit. ex Ait. Hort. Kew ed. 1, ii (1789) 414.
Vernacular name: Khotol (Waziri).
Locality: *N.W.*: Datta Khel village, 4,600 ft. (B. & F. 1332 ! 1449 ! 1486 !).—Boya (F. 1103 !).—Miram Shah (B. & F. 562 !).—Bed of Tochi River (B. & F. 502 !).—Chasmai River (B. & F. 200 ! 323 !).—Spinwam Fort (B. & F. 443 !).—Dossali Fort (B. & F. 1154 !).—Common everywhere.
S.W.: Barwand, 4,000 ft. (Duthie's Collect. 15719 !).—N. of Doboi, 5,000 ft., on a feeder of the Zam, abundant (Stewart).—Razmak, 6,750-7,300 ft. (B. & F. 1718 ! 1755 ! 1780 !).
Flowers & Fruit: March to May 1930.
Distribution: Throughout Europe and temperate N. Asia, America.

Erodium cicutarium var. trixiale Trautv. in Acta Hort. Petrop. iv (1876) 122.
Locality: *S.W.*: N. of Razmak Camp, near Springs, 6,750-7,300 ft. (B. & F. 1765 !).
Flowers & Fruit: 25-4-30.
Distribution: Of type.

Erodium cicutarium var. primulaceum Brumh. Mon. Uebers. Erod. (1905) 54.
Vernacular name: Khotol (Waziri).
Locality: *N.W.*: Datta Khel village, 4,600 ft. (B. & F. 1485 !).—Boya, 3,550 ft. (F. 1107 !).
S.W.: Razmak, 6,750 ft. (F. 2293 !).
Flowers & Fruit: April to May 1930.
Distribution: Europe, Mediterranean, Orient, temperate N. Asia.

Erodium Stephanianum Willd. Sp. Pl. iii (1800) 625.
Locality: *N.W.*: Boya Fort, clayey sand, 3,550 ft. (B. & F. 76 !).
Flowers & Fruit: 21-3-30.
Distribution: Temperate Asia.

Erodium bryoniæfolium Boiss. Diagn. ser. 1, i (1842) 61.
Locality: *N.W.*: Shewa Post, bed of Volam River, 2,150 ft. (B. & F. 911 !).
Flowers & Fruit: 5-4-30.
Distribution: Mediterranean, Orient, Afghanistan, Baluchistan.

Erodium triangulare (Forsk.) Muschler Fl. Egypt. i (1912) 558.
Locality: *N.W.*: E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 650 !).—Boya, on gravel, 3,550 ft. (B. & F. 1668 !).
Flowers & Fruit: 1-4-30 (Spinwam Fort); 21-4-30 (Boya).
Distribution: Mediterranean, Orient, Abyssinia.

Erodium adenophorum Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 477.
Locality: *N.W.*: Khajuri Post, bed of Sua Algad, gravel and sand (B. & F. 368 !).
Flowers & Fruit: 26-3-30.

Erodium heterosepalum Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 478.
Locality: *N.W.*: E. of Miram Shah Fort, right bank of Chasmai River, on sand between rocks, 3,100 ft. (B. & F. 201 !).
Flowers & Fruit: 23-3-30.

Erodium nanum Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 477.
Locality: *N.W.*: W. of Datta Khel Fort, gravel plain (B. & F. 613 !).
Flowers & Fruit: 13-3-30.

Erodium malacoides Willd. Phyt. 10.
Locality: *N.W.*: In a bed of Kuram River near Shewa Post, 2,150 ft. (B. & F. 954 !).
Flowers: 5-4-30.
Distribution: Punjab, westwards to S. Europe, N. Africa.

CARYOPHYLLACEAE. [1]

(The specimens collected by Blatter & Fernandez were kindly identified by Prof. Dr. Joh. Mattfeld of Berlin. See Fedde, Repertorium xxxi (1933) 334-336.)
80 genera. 1300 species.—Cosmopolitan.

Dianthus L.

250 species.—Europe, Asia, Africa, especially Mediterranean.

Dianthus crinitus Smith in Trans. Linn. Soc. ii (1794) 300.
Locality: *S.W.*: Pre Ghal (Hay).—Sarwekai, 3,500 ft., nala (F. 4008 !).—Spin, 2,900 ft., stony plain (F. 4057 !).
Flowers: 8-6-27 (Sarwekai); September.
Distribution: N.-W. India, Persia, Asia Minor.

* **Dianthus barbatus** L. Sp. Pl. 409.
Vernacular name: Sweet William.
Locality: *S.W.*: Razmak, in garden (B. & F. !).
Flowers: April.
Distribution: Russia to China and south to the Pyrenees.

* **Dianthus Caryophyllus** L. Sp. Pl. 410.
Vernacular name: Carnation, Clove Pink, Picotee, Grenadine.
Locality: *S.W.*: Razmak, in garden (B. & F. !).
Flowers: April.
Distribution: Mediterranean region, W. Asia.

Dianthus sp.
Locality: *S.W.*: Near Kaniguram (Stewart).

Acanthophyllum C. A. Mey.

25 species.—Western Asia, Siberia.

Acanthophyllum macrodon Edgew. in Hook. f. Fl. Brit. Ind. i, 216.
Locality: *N.W.*: N.-E. of Razmak (Stewart).—Siroba (Stewart).

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[1] This order should be inserted after the *Polygalaceae*.

Flowers: May (Razmak, Siroba).
Distribution: Afghanistan.

Acanthophyllum sp.
Locality: *S.W.* (Duthie's Collect. 15777 !).

GYPSOPHILA L.

55 species.—Europe, Asia, especially E. Mediterranean.

Gypsophila Stewartii Thoms. in Hook. f. Fl. Brit. Ind. i, 216.
Locality: Waziristan (Stewart).
S.W.: (Duthie's Collect. 15792 !).
Distribution: Afghanistan.

SILENE L.

320 species.—N. temperate, especially Mediterranean.

Silene conica L. Sp. Pl. (1753) 598.
Locality: *N.W.*: In the plains (Stewart).
Distribution: Central and S. Europe, Orient.

Silene conoidea L. Sp. Pl. (1753) 598.
Vernacular name: Khoda (Waziri).
Locality: *N.W.*: Near Datta Khel village, 4,600 ft. (B. & F. 1423 ! 1424 !).—Boya, W. of fort, 3,550 ft. (F. 1363 !).
Flowers: 7-4-27 (Boya); 17-4-30 (Datta Khel).
Distribution: W. Himalaya, W. Tibet 8,000-11,000 ft. westwards to the Atlantic Ocean.

Silene arenosa C. Koh. in Linnaea xv, 711.—*S. leyseroides* Boiss. Diagn. ser. i, 1, 41.—*S. salsa* Boiss. l.c. 8, 77.
Locality: *N.W.*: In the plains (Stewart).
Tank: Near Tank (J. Williams 7113 !).
Flowers: 9-5-1888 (Tank).
Distribution: W. Punjab, Afghanistan, Persia, Armenia.

Silene aff. Moorcroftiana Wall. Cat. 626.
Locality: *S.W.*: Pre Ghal (Hay).

* **Silene Saxifraga** L. Sp. Pl. 421.
Locality: *S.W.*: Razmak, in garden (B. & F. !).
Flowers: April.
Distribution: Europe, Asia Minor.

CERASTIUM L.

100 species.—Northern temperate.

Cerastium dichotomum L. Sp. Pl. (1753) 628.
Locality: *N.W.*: Near Datta Khel Fort, left bank of Dariawasti Algad, 4,500 ft. (B. & F. 1649 !).—N. of Dossali Fort, 4,900 ft. (B. & F. 1061 !).
S.W.: N. of Razmak towards Springs, stony ground, 6,800 ft. (F. 2412 ! 2424 !).—S.W. of Razmak, 6,950 ft. (B. & F. 1932 !).—N. of Razmak Camp, below the Springs, 7,700 ft. (B. & F. 1798 !).—Slopes of Shuidar Peak from Datta Khel, 5,700 ft. and below (B. & F. 1609 !).
Flowers: 11-4-30 (Dossali Fort); 18-4-30 (Shuidar); 25-4-30 (Razmak); 2-5-27 (Razmak).
Distribution: Spain, Mediterranean, Orient.

Cerastium viscosum L. Sp. Pl. 627.
Locality: *N.W.*: Razani (Stewart).
S.W.: Kaniguram (Stewart).
Distribution: Afghanistan, Greece, Syria, almost cosmopolitan.

STELLARIA L.

100 species.—Cosmopolitan.

Stellaria media (L.) Cyrill. Char. Com. (1784) 36.
Locality: *S.W.*: Upper regions (Stewart).

Distribution: Punjab and temperate regions of India, up to 14,500 ft. in Western Tibet, all arctic and north temperate regions.

Stellaria Blatteri Mattf. In Feddes Rep. xxxi (1933) 334-336. *Spec. nov.*—Nearly related to *Stellaria Kotschyana* Fenzl., but the flowers are considerably larger and the calyx segments long acuminate; the leaves are sessile, broadest at the base and then slowly getting narrower towards the apex.

Locality: *N.W.*: Datta Khel, stony plain, 4,600 ft. (B. & F. 1333 ! in herb Berol. 1360 !).—4 miles outside Datta Khel Fort, right side of road in shade of trees (B. & F. 607 !).

Flowers: 16-4-30 (Datta Khel); 30-3-30 (near Datta Khel).

Fruit: 16-4-30 (Datta Khel).

MINUARTIA L.

Minuartia Meyeri (Boiss.) Bornm. in Beih. Bot. Centralb. xxvii, ii. (1910) 318.

Locality: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1357 !).

Flowers: 16-4-30 (Datta Khel).

Distribution: Mediterranean, Persia, Turkestan, Afghanistan.

ARENARIA Rupp. ex L.

100 species.—Northern temperate.

Arenaria neelgerrensis Wight & Arn. Prodr. (1834) 43.

Locality: *N.W.*: Slope of ravine below Razmak Narai, 6,400 ft. (B. & F. 1208 !).

S.W.: Pre Ghal (Duthie's Collect. 15607 !).—E. of Razmak, stony plateau, 6,800 ft. (F. 1921 !).—N.-E. E. of Razmak, Bare patch hill, 7,500 ft. (F. 3184 !).

Flowers: 14-4-30 (Razmak Narai); 5-5-27 (Razmak); 12-5-1895 (Pre Ghal).

Distribution: N.-W. Himalaya, Nilgiris, S. districts of Bombay.

Arenaria serpyllifolia L. Sp. Pl. 423.

Locality: *N.W.*: Hills E. of Miram Shah Fort, 3,600 ft. (B. & F. 535a !).—Bed of Chasmai River, on sand, 3,100 ft. (B. & F. 304 !).—N. of Dossali Fort (B. & F. 1059 !).—2 miles above Dossali Fort, in sandy bed of Khunai River (B. & F. 1134a !).—Below Razani, in bed of Khunai River, 5,050 ft. (B. & F. 1124 !).—Razani (F. 2170 !).—Below Razmak Narai in ravine, 6,650-7,000 ft. (B. & F. 1223 !).—Stony plain E. of Datta Khel Fort, 4,600 ft. (B. & F. 1367 !).

S.W.: N. of Razmak Camp, below the Springs, 7,700 ft. (B. & F. 1793 ! 1807 !, F. 2399 !).—E. of Razmak Camp, slope of hill above 6,800 ft. (B. & F. 1919 !).

Flowers: 24-3-30 (Chasmai River); 29-3-30 (Miram Shah); 11-4-30 (N. of Dossali Fort); 12-4-30 (Below Razani); 14-4-30 (Below Razmak Narai); 23-4-27 (Razani); 25-4-30 (Razmak); 2-5-27 (Razmak).

Distribution: Subtropical and temperate Himalaya, western Tibet up to 13,000 ft., Afghanistan, temperate Europe and Asia.

Arenaria holosteoides Edgew. in Hook. f. Fl. Brit. Ind. i. 241.

Vernacular name: Makhlak (Waziri).

Locality: *N.W.*: Datta Khel Fort, Scouts' garden, 4,600 ft. (B. & F. 1382 ! 1383 !).—Datta Khel village, along water channel, 4,600 ft. (B. & F. 1448 !).—Plain E. of Datta Khel Fort, 4,600 ft. (B. & F. 1359 !).—4 miles from Datta Khel Fort, under shade of trees (B. & F. 594 !).—Razani village, 5,000 ft. (F. 2191 ! 2197 ! 2748 ! 3132 ! 3192 !).

S.W.: Kaniguram, 6,500 ft. (Duthie's Collect. 15768).—N. of Razmak Camp, below Springs, 7,700 ft. (B. & F. 1798a ! 1799 !).

Flowers: 30-3-30 (Datta Khel Fort); 17-4-30 (Datta Khel); 23-4-27 (Razani); 25-4-30 (Razmak); 13-5-95 (Kaniguram).

Distribution: W. temperate Himalayas, Afghanistan, Baluchistan, westwards to Asia Minor, Soongaria.

SPERGULARIA J. *et* C. Presl.

20 species.—Cosmopolitan.

Spergularia diandra (Guss.) Boiss. Fl. Or. i, 733.
Locality: *N.W.*: Plain E. of Miram Shah Fort, sandy soil, 3,150 ft. (B. & F. 143 !).—Right bank of Chasmai River, 3,100 ft. (B. & F. 209 ! 263 !).—Khajuri Post, left bank of Tochi River (B. & F. 420 !).
Flowers: 22-3-30 (Miram Shah); 26-3-30 (Chasmai).
Distribution: Southern Europe, Mediterranean, Abyssinia, Orient, Soongaria, Siberia.

Spergularia rubra J. & C. Presl Fl. Cech. 94.
Locality: *S.W.*: In the lower regions (Stewart).
Distribution: Europe, Mediterranean, Orient, Siberia.

Spergularia media Presl Fl. Sic. (1819) 17.—*Spergula media* Bartl. & Wendl. f. Beitr. Bot. ii, 64.
Locality: Lower Zone (Stewart).
Distribution: Mediterranean, Orient, Siberia.

SPERGULA L.

3 species.—Temperate regions.

Spergula flaccida Aschers. in Verh. d. Bot. Ver. Prov. Brandby. xxx (1889) p. xxxiv-xlix.—*Arenaria flaccida* Roxb. Fl. Ind. ii (1832) 447.—*Spergula pentandra* L. Sp. Pl. 630.
Locality: *Tank* (J. Williams 7775 !).
Fruit: 28-5-1888 (Tank).
Distribution: Europe, Mediterranean, Orient, throughout the northern hemisphere.

OXALIDACEAE.

870 species.—Mostly tropical and subtropical.

OXALIS L.

About 800 species.—Cosmopolitan, chiefly S. Africa and America.

Oxalis corniculata L. Sp. Pl. (1753) 435.
Vernacular name: Indian Sorrel; Tervikai (Waziri).
Locality: *S.W.*: Near Kaniguram brook (Stewart).
Flowers: September 1860 (Kaniguram).
Distribution: In all tropical and temperate climates.

Oxalis corniculata L. **var. corniculata** Zucc. in Abh. Akad. Münch. i (1829-30) 230.
Locality: *N.W.*: Near Datta Khel Fort, right bank of Dariawasti Algad, on gravel (B. & F. 1647 !); Boya, along irrigation channel (B. & F. 117 !).—Dossali Fort, nala (B. & F. 1048 ! 1054 !).—Below Dossali Fort, left bank of Khaisora River (B. & F. 1156 !); stony plain, 4,900 ft. (B. & F. 981).—Razani (F. 2924 !).—Razmak Narai, 6,650 ft. (B. & F. 1248 !).
S.W.: N. of Razmak, on gravel on way to Spring, 6,750-7,300 ft. (B. & F. 1790 !).
Flowers & Fruit: 21-3-30 (Boya); 10-4-30 (Dossali); 19-4-30 (Datta Khel).
Distribution: Of type.

Oxalis corniculata L. **var. repens** Zucc. in Abh. Akad. Münch. i (1829-30) 230.
Locality: *S.W.*: Jandola, 2,270 ft. (F. 276 !).—Razmak, stony plain (B. & F. 1711 !).
Flowers & Fruit: 24-4-30 (Razmak).
Distribution: Of the type.

Oxalis foliosa Blatter in Journ. Ind. Bot. Soc. ix (1930) 203.
Locality: *N.W.*: Razani, 5,000 ft. (F. 2599 ! 2915 ! 2940 ! 2943 ! 1455 !).

S.W.: Razmak, in open stony plain, 6,300 ft. (F. 1636 ! co-type, 2717 !).—Sararogha, 4,000 ft. (F. 173 ! type, 144 ! 170 !).
Flowers: April, May.
Fruit: May.

BALSAMINACEAE.

430 species.—Asia, Africa, Europe, N. America.

Impatiens Riv. ex L.

340 species.—Tropics and N. temperate regions, especially Mountains of India and Ceylon.

Impatiens sp.
Locality: *S.W.*: Pre Ghal (Hay).

Impatiens sp.
Locality: *S.W.*: Near Kaniguram (Stewart).

Impatiens sp.
Locality: *S.W.*: S.-W. of Razmak Camp, river-bed, 6,750 ft. (B. & F. 1928 !).

RUTACEAE.

800 species.—Tropical and temperate regions, especially S. Africa and Australia.

Citrus.

10 species.—Palaeotropics and subtropics.

***Citrus aurantium** L. Sp. Pl. (1753) 782.
Vernacular name: Navrajh (Waziri).
Locality: *N.W.*: Miram Shah (F. 1089 !).
Flowers: 16-4-27 (Miram Shah).

MELIACEAE.

600 species.—Warm countries.

Melia L.

15 species.—Palaeotropics and subtropical regions.

***Melia Azedarach** L. Sp. Pl. (1753) 384.
Vernacular name: Persian Lilac, Bead Tree, Bastard Cedar, Bakanra, Drakh (Pu.).
Locality: *N.W.*: Miram Shah (B. & F. !).—Spinwam (B. & F. 960 !).
Flowers: March, April; leaves coming out.
Distribution: Sub-Himalayas, Persia, China.

Cedrela.

100 species.—Tropical Asia, Australia, America.

***Cedrela Toona** Roxb. ex Rottl *et* Willd. in Ges. Naturf. Fr. Neue Schr. iv (1803) 198.
Vernacular name: The Toon Tree.
Locality: *N.W.*: Boya, introduced, 4,000 ft. (F. 997 ! 1063 !).—Miram Shah 3,150 ft. (B. & F. 41 !).
Flowers: 19-3-30 (Miram Shah); April (Boya).
Distribution: Indo-Malaya, Australia.

CELASTRACEAE.

480 species.—Tropical and temperate regions.

Euonymus L.

100 species.—N. temperate and S.-E. Asia.

Euonymus hamiltonianus Wall. in Roxb. Fl. Ind. ed. Carey ii (1824) 403.

Locality: *S.W.*: Slopes of Shuidar, 7,000-9,000 ft. (B. & F. 1601 !).
Distribution: W. Himalaya, 4,000-9,000 ft., Trans-Indus.

GYMNOSPORIA Benth. & Hook. f.

80 species.—Tropics and subtropics, especially Africa.

Gymnosporia montana Benth. Fl. Austral. i (1863) 400.
Locality: *S.W.*: Jandola (F. 4098 !).

Gymnosporia royleana Wall. Cat. (1828) 4317.
Vernacular name: Sagharzai (Waziri).
Locality: *N.W.*: Near Spinwam Fort, slopes of Chota Darweshta, 2,750-3,000 ft. (B. & F. 717 !).—Hills E. of Miram Shah Fort (B. & F. 529 !).—Shewa Post, left bank of Volam River (B. & F. 894 !).—Boya (F. 567 !).
Flowers: 2-4-30 (Spinwam); 5-4-30 (Shewa Post).
Fruit of previous year: 8-4-27 (Boya).
Distribution: W. Himalaya, 1,000-4,000 ft., Kumaon to Garhwal, Salt Range, Afghanistan.

RHAMNACEAE.

500 species.—Cosmopolitan.

ZIZYPHUS Tourn. ex L.

40 species.—Indo-Malaya, tropical America, Africa, Australia, Mediterranean.

***Zizyphus Jujuba** Lam. Encycl. iii (1789) 318.
Vernacular name: Berra (Pu.); Ber. (Hind.); Berae, Karkana (Waziri).
Locality: *N.W.*: Miram Shah, planted (B. & F. !, F. 799 !).—Spinwam, abundant (Stewart).—Boya (F. 1521 !).
S.W.: Palosina (Stewart); Sararogha (F. 225 ! 226 !).—Tenai Post (F. 4283 !).
Tank (Stewart).
Flowers: April 1860 (Palosina).
Distribution: Indigenous and naturalized throughout India and Burma, ascending to 6,000 ft. in the Himalayas.

***Zizyphus Jujuba var. hysudrica** Edgew. Journ. Linn. Soc. vi, 201.
Locality: *S.W.*: Jandola, on dry slopes and banks of Tank River (F. 776 !).

Zizyphus nummularia W. & A. Prodr. 162.
Vernacular name: Karkan (Pu.); Jharberi (Hind.); Karkana, Bera (Waziri).
Locality: *N.W.*: Miram Shah (F. 796 !).—E. of Spinwam Fort, base of nearest hills, on gravel (B. & F. 765 !).
S.W.: Jandola (F. 4103 !).—Sarwekai (F. 3971 !).
Tank (Stewart).
Distribution: Sind, Baluchistan, dry region of N.-W. India and the Deccan, Persia.

Zizyphus Spina Christi Willd. Sp. Pl. (1797) 1107.
Vernacular name: Karkana (Waziri).
Locality: *S.W.*: Sararogha, dry open country (F. 606 !).—Spin (F. 3842 !).
Distribution: Afghanistan, Persia, Arabia, Egypt, tropical Africa.

Zizyphus sativa Gaertn. Fr. i (1788) 202.—*Z. vulgaris* Lam. Ill. i, 316, t. 185; Boiss. Fl. Or. ii, 11.—*Rhamnus Zizyphus* L. Sp. Pl. (1753) 194.
Vernacular name: Karkanbera (Waziri).
Locality: *N.W.*: Boya (F. 428 !).—Miram Shah, open stony ground (F. 436 !).
S.W.: Upper regions (Stewart).—Sarwekai (F. 4407 !).—Sarwekai to Dargai (F. 3711 !).
Distribution: Punjab, Trans-Indus, Punjab Himalaya, wild and cultivated, Baluchistan, Orient, Europe, China, Japan.

BERCHEMIA Neck.

15 species.—Palaeotropics, Atlantic N. America.

Berchemia lineata DC. Prodr. ii, 23.
Locality: *S.W.*: Pre Ghal (Duthie's Collect. 15610 !).—Between Makin and Razmak (Stewart).
Fruit: 19-5-1895 (Pre Ghal); September 1860 (Razmak).
Distribution: N.-W. Himalaya, Sikkim, China.

Berchemia sp.
Locality: *S.W.*: Near Razmak (Stewart).

RHAMNUS Tourn. ex L.

100 species.—Cosmopolitan.

Rhamnus dahuricus Pall. Fl. Ross. ii, t. 61.—*Rhamnus virgatus* Roxb. Fl. Ind. i (1832) 604.
Locality: *N.W.*: Razani (Stewart).
Flowers: May (Razani).
Distribution: Temperate Himalaya, from Jammu and Simla, to Bhutan, 4,000-9,500 ft. Punjab, W. Peninsula, China, Japan.

SAGERETIA Brongn.

12 species.—Warm E. Asia, N. America.

Sageretia Brandrethiana Aitch. in Journ. Linn. Soc. viii, 62.
Vernacular name: Mumani (Afgh.).
Locality: *S.W.*: Near Anai, above Palosina, abundant (Stewart).—N.-E. of Razmak (Stewart).
Distribution: N.-W. India, Salt Range, westwards to Persia and Arabia.
Uses: Fruit very pleasant (Stewart).

VITACEAE.

450 species.—Mostly tropical and subtropical.

VITIS (Tourn.) L.

40 species.—N. hemisphere.

***Vitis vinifera** L. Sp. Pl. (1753) 202.
Vernacular name: The Grape Vine; Melawa, Angir (Waziri).
Locality: *N.W.*: Miram Shah (B. & F. !, F. 1070 !).—Boya (F. 891 !).
S.W.: Wana (F. 3617 !).
Distribution: Indigenous in the Barbary States to the Transcaucasus.

SAPINDACEAE

1,000 species.—Tropics and subtropics.

DODONAEA L.

50 species.—Tropics, especially Australia.

Dodonaea viscosa L. Mant. Pl. ii (1771) 149.—*D. Burmanniana* DC. Prodr. i, 616.
Vernacular name: Zadavanai (Waziri); Levanai vojair (Mashudi).
Locality: *N.W.*: Miram Shah (F. 1408 !); cultivated (B. & F. 28 !).—Isha (B. & F. 28a !).—W. of Spinwam Fort, dry nalas of Chota Darweshta, 3,000-4,800 ft. (B. & F. 735 !).—N. of Dossali Fort, plain and nalas (B. & F. 1289 !).—Dwa Warkha, abundant (Stewart).
S.W.: Near Anai above Palosina, common (Stewart).—Sararogha (F. 183 ! 190 ! 203 !).—Jandola, planted in garden (F. 3891 !).
Flowers: 19-3-30 (Miram Shah); 2-4-30 (Spinwam).
Fruit: 21-5-27 (Sararogha).
Distribution: All warm countries.

ANACARDIACEAE.

500 species.—Chiefly tropical, but also Mediterranean, E. Asia, America.

RHUS (Tourn.) L.

130 species.—Subtropical and warm temperate.

Rhus cotinus L. Sp. Pl. (1753) 267.
Locality: *N.W.*: In the upper regions (Stewart).
Distribution: Western subtropical Himalaya, 3,000-5,000 ft., from Murree to Kumaon.—From Syria westwards to France.

PISTACIA L.

5 species.—Mediterranean, E. Asia, Mexico.

Pistacia integerrima Stewart ex Brandis For. Fl. (1874) 122, t. xxii.—*P. Kinjuk* Stocks in Kew Journ. iv, 143.—*P. Kinjuk* Stocks *var. Stocksii* Engl. in DC. Monogr. Phan. iv, 291.
Vernacular name: Vojgai, Ushgai (Waziri). Fruit called Sna (Waziri).
Locality: *N.W.*: Razani (F. 2054 !).—Boya (F. 1378 ! 1380 !).
S.W.: Wana (F. 3676 ! 3677 ! 3678 ! 3680 ! 3684 ! 3685 !), on hills among rocks (F. 3423 ! 3679 ! 3693 !).
Flowers: 6-4-27 (Boya); 20-4-27 (Razani).
Fruit: 16-6-27 (Wana).
Distribution: N.-W. Himalaya, 1,500-8,000 ft., Punjab, Salt Range, Baluchistan.

Pistacia mutica Fisch. *et* Mey. in Bull. Soc. Nat. Mosc. (1838) 338.—*P. cabulica* Stocks in Kew Journ. iv, 143.
Vernacular name: Shnee (Pu.); Sravan (Waziri).
Locality: *N.W.*: Razani (Stewart).—Chota Darweshta, rocky slope, 3,000-4,000 ft. (B. & F. 730 ! 731 !).
Distribution: Baluchistan, Kuram Valley, Afghanistan, Gilgit, Mediterranean.

SCHINUS L.

12 species.—Mexico to Argentine.

***Schinus Molle** L. Sp. Pl. 388.
Vernacular name: The Pepper Tree.
Locality: *N.W.*: Miram Shah (B. & F. 426a !).
S.W.: Wana (F. 3661 !).
Flowers: March, April.
Fruit: April.
Distribution: America.

PAPILIONACEAE.

ARGYROLOBIUM Eckl. *et* Zeyh.

60 species.—Africa, Mediterranean to India.

Argyrolobium strigosum Blatter in Journ. Ind. Bot. Soc. ix (1930) 205.—Standard whitish with long purplish streaks, wings pale pink, keel white tinged reddish brown tipped.
Vernacular name: Tervikai (Waziri).
Locality: *N.W.*: E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 657a !); gravel plain (B. & F. 848 !).—Miram Shah, banks of Tochi River, 3,100 ft. (F. 359 ! 363 !); left bank of Chasmai River, 3,150 ft. (B. & F. 279 ! 300 !).—Khajuri Post, ridge on left bank of Sua Algad, 2,450 ft. (B. & F. 388 !).—Boya, cultivated ground (F. 1122 !).—W. of Miram Shah Fort, nearest hills, rocky top, 3,200 ft. (B. & F. 23 !).—W. of Spinwam Fort, gravel and boulder slopes of Chota Darweshta, 2,730 ft. (B. & F. 702 !).—Spinwam Fort, left bank of Kaitu River, 2,600 ft. (B. & F. 446 !).—Razani (F. 2734 !).—Above Dossali Fort, bed of Khunai River, 5,500 ft. (B. & F. 1087 !).

S.W.: Sararogha, 4,000 ft. (F. 163 !).—Tenai Post on stony ground, 3,200 ft. (F. 4046 !).—Dargai Post (F. 4972 !).

Flowers & Fruit: 19-3-30 (Miram Shah); 24-3-30 (Chasmai River); 26-3-30 (Khajuri); 27-3-30, 1-4-30 (Spinwam); 5-4-27 (Boya); 12-4-30 (Dossali); 19-4-27 (Razani); 22-6-27 (Dargai Post).

Uses: Viscid when crushed and smelling badly; eaten, considered to be cooling.

Argyrolobium Kotschyi Boiss. Diagn. ser. i, 6, p. 32; Fl. Or. ii (1872) 33.

Locality: *N.W.*: Miram Shah, along bank of Tochi River, 3,200 ft. (F. 2597 !).

S.W.: Jandola, open stony ground and nalas, 2,300 ft. (F. 666 !).

Flowers: April, May.

Fruit: May, June.

Distribution: Persia.

Argyrolobium roseum Jaub. & Sp. in Ann. Sc. Nat. ser. 2, xix, 51.

Locality: *N.W.*: N. of Dossali Fort, nala (B. & F. 1067 !).

S.W.: Pre Ghal (Duthie's Collect. 15706 !).

Flowers: 11-4-30 (Dossali); 27-4-1895 (Pre Ghal).

Distribution: N.-W. India up to 7,000 ft., Baluchistan, Persia.

Argyrolobium mucilagineum Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 481.

Note: Viscid when crushed, evil-smelling.

Locality: *N.W.*: Below Shewa Post, left bank of Volam River, 2,150 ft. (B. & F. 870 !); E. of Spinwam Fort, sandstone nala 2,650 ft. (B. & F. 657 !).

Flowers & Fruit: 1-4-30 (Spinwam); 5-4-30 (Shewa Post).

Argyrolobium purpurascens Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 480.

Locality: *N.W.*: Near Datta Khel Fort, Dariawasti Algad, 4,600 ft. (B. & F. 1642 !).

Flowers & Fruit: 19-4-30.

CROTALARIA Dill. ex L.

350 species.—Tropical and subtropical regions.

Crotalaria Burhia Ham. in Wall. Cat. (1828) 5386.

Locality: *Tank* (Stewart).

Flowers: April 1860 (Tank).

Distribution: N.W. India, Rajputana Desert, Gujarat, Sind, Baluchistan, Afghanistan.

Uses: 'A plant with a remarkably tough fibrous bark, which might possibly be of use as a textile material.' (Stewart).

TRIFOLIUM (Tourn.) L.

290 species.—Temperate and subtropical regions.

Trifolium resupinatum L. Sp. Pl. i (1753) 1086; Reichb. Ic. xxii, t. 107, fig. ii.—*T. bicorne* Forsk. Fl. Aeg.—Arab. 139.—*T. suaveolens* Willd. Enum. Hort. Berol. t. 108.

Vernacular name: Shevtalai, Shevtala, Shatal.

Locality: *N.W.*: Datta Khel, 4,400 ft., cultivated (F. 1301 !).—Boya, 3,400 ft., cultivated (F. 1157 !).—Miram Shah, 3,100 ft., cultivated (F. 299 !, B. & F. 495 !).—Razani, 5,000 ft., cultivated (F. 2214 ! 2215 ! 2216 !).

Tank (J. Williams 9133 !).

Flowers: 12-5-1888 (Tank).

Distribution: Mediterranean, Caucasus, Mesopotamia, Persia, Afghanistan, Kuram Valley.

Uses: Eaten by horses. (Williams).

Trifolium pratense L. Sp. Pl. 1082.

Locality: *S.W.*: Kaniguram, 6,500 ft. (Duthie's Collect. 15749).

Flowers: 14-5-1895 (Kaniguram).

Distribution: Europe, Orient, Afghanistan, Arctic Russia, Siberia.

Trifolium fragiferum L. Sp. Pl. (1753) 1086; Boiss. Fl. Or. ii (1872) 135.—*T. neglectum* F. & M. Ind. Petrop. ix, Suppl. p. 21.—*T. congestum* Link. In Linnaea ix (1834-5) 584 (non Guss.); DC. Prodr. ii, 202.

Locality: *S.W.*: Wana, open stony plain, 4,500 ft. (F. 3497 ! 3500 ! 3510 !).—Sarwekai 3,500 ft. (F. 3978 !).

Flowers: June.

Distribution: Central Europe, Mediterranean, N. Africa, Abyssinia, Syria, Palestine, Persia, Turkestan, Afghanistan, Baluchistan, Kashmir.

Trifolium repens L. Sp. Pl. 1080.

Locality: *S.W.*: Kaniguram, 6,500 ft. Duthie's Collect. 15747 !).—Near Kaniguram brook (Stewart).—In nala below Springs N. of Razmak, 7,700 ft. (B. & F. 1800 !).

Flowers: 25-4-30 (Razmak); 14-5-1895 (Kaniguram).

Distribution: Europe, Orient, Siberia, N. America.

Trifolium sp

Vernacular name: Shevtalai.

Locality: *S.W.*: Razmak, 6,300 ft. (F. !).

TRIGONELLA L.

70 species.—Mediterranean, Europe, Asia, S. Africa, Australia.

Trigonella incisa Benth. in Royle Illustr. Him. 197. *Reducta ad T. polyceratam Linn. a cl. Baker.*

Vernacular name: Malakint (Waziri).

Locality: *N.W.*: Near Miram Shah Fort, bed of Chasmai River, in gravel and sand, 3,100 ft. (B. & F. 222 ! 257 !).—E. of Miram Shah Fort, sand near water, 3,150 ft. (B. & F. 147 ! 150 !).—Datta Khel Fort, 4,600 ft. (B. & F. 1329 ! 1354 ! 1395 !).—Boya Fort, right bank of Tochi River, 3,550 ft. (B. & F. 104 !).—Razani (F. 2571 !).—Dossali Fort (B. & F. 1127 ! 1185 !).

S.W.: W. of Razmak, stony plain, 6,800 ft. (B. & F. 1740 !).

Flowers & Fruit: 22-3-30 (Miram Shah); 23-3-30 (Chasmai River); 12-4-30 (Razmak); 17-4-30 (Datta Khel); 23-4-27 (Razani).—24-4-30 (Razmak).

Distribution: Baluchistan.

Trigonella polycerata L. Sp. Pl. 777.

Locality: *S.W.*: Palosina, profuse (Stewart).

Flowers: April (Palosina).

Distribution: W. Himalaya, up to 6,000 ft., Punjab Plain, extending to W. Siberia and S. Europe.

Trigonella emodi Benth. in Roy. Ill. 197.

Locality: *S.W.*: Kaniguram brook (Stewart).

Distribution: W. Himalaya, from Kashmir to Nepal, 4,000-10,000 ft., Afghanistan, Persia, Orient.

Trigonella dimorpha Blatter in Journ. Ind. Bot. Soc. ix (1930) 204.

Locality: *N.W.*: Razani (F. 2583 !).

S.W.: Razmak, 6,300 ft. (F. 3285 ! 3306 !).

Flowers & Fruit: 23-4-27 (Razani); May 1927 (Razmak).

Distribution: Endemic.

Trigonella Noeana Boiss. Diagn. ser. ii, 2, 11.

Nostris in plantis calyx dimidiam corollam attingit. Legumen pilosum.

Vernacular name: Makhlindai (Waziri).

Locality: *N.W.*: Datta Khel village, along irrigation channel, 4,600 ft. (B. & F. 1447 !).—S. of Miram Shah Fort, stony plain, 3,150 ft. (B. & F. 976 !).—N. of Dossali Fort, in nala (B. & F. 1063 !).—E. of Miram Shah Fort, bank of Chasmai River, 3,100 ft. (B. & F. 278 !).—Near Shewa Post, bed of Kuram River (B. & F. 945 !).—E. of Datta Khel Fort broken stony plain, 4,600 ft. (B. & F. 1376 !).

Flowers & Fruit: 23-3-30 (Chasmai); 5-4-30 (Shewa Post); 9-4-30 (Miram Shah); 11-4-30 (Dossali); 17-4-30 (Datta Khel village).

Distribution: Asia Minor, Armenia, Mesopotamia, Persia.

Trigonella psilorhynchos Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 479.
Locality: *S.W.*: W. of Razmak Camp, stony plain, 6,800 ft. (B. & F. 1721 !).
Flowers & Fruit: 24-4-30.

Trigonella lasia Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 479.
Locality: *N.W.*: Below Razmak Narai, slope of ravine, 7,000 ft. (B. & F. 1210 !).
S.W.: Razmak, 6,750 ft. (F. 1841 ! 1883 ! 2320 !).—E. of Razmak, small stony plateau, 6,800 ft. (B. & F. 1905 ! 1925 !).—Bare Top Hill, E. of Razmak, 7,000 ft. (F. 3373 !).
Flowers & Fruit: 25-4-30; 6-5-27 (Razmak).

Trigonella subracemosa Boiss. Fl. Or. ii (1872) 73.
Locality: *N.W.*: Dossali Fort, left side of river-bed of Khaisora (B. & F. 1164 !).
Flowers & Fruit: 13-4-30 (Dossali Fort).
Distribution: Asia Minor, Armenia.

Trigonella longe-pedunculata Blatter in Journ. Ind. Bot. Soc. ix (1930) 204.
Perennial. Standard with faint lines, midvein broader and purple. Compare *T. calliceras* Fisch.
Vernacular name: Tervikai (Waziri).
Locality: *N.W.*: Razani (F. 2165 ! 2224 !).—Below Razmak Narai, slope of ravine, 7,000 ft. (B. & F. 1234 ! 1247 !).
S.W.: Razmak, 6,300 ft. (F. 2376 ! type; 3044 ! co-type; 2439 ! 3023 ! 3025 ! 3041 !).—E. of Razmak Camp, slope of hill, 6,800 ft. (B. & F. 1906 !).—W. of Razmak, stony plain, 6,800 ft. (B. & F. 1695 ! 1731 !).
Flowers & Fruit: 14-4-30 (Razmak Narai); 23-4-27 (Razani); 25-4-30, 2-5-27 (Razmak).
Distribution: Endemic.

Trigonella sp. *affinis T. subracemosae* Boiss.
Villosa. Calyx corolla vix brevior; pedunculus folio longior; foliola obovato-rotundata subemarginata obtuse denticulata. Legumen deest.
Locality: *S.W.*: W. of Razmak Camp, stony plain, 6,800 ft. (B. & F. 1727 !).
Flowers & Fruit: 24-4-30.

Trigonella sp.
Resembles *Trigonella longepedunculata* Blatter, but the flowers are larger and the peduncles are much longer.—No fruit.
Locality: *S.W.*: Razmak, 6,300 ft. (F. 3098 !).
Flowers: May.

MELILOTUS Tourn. ex Hall.

20 species.—Temperate and subtropical regions of the Old World.

Melilotus indicus L. Sp. Pl. (1753) 1077.
Locality: *N.W.*: Dwa Warkha (Stewart).
Distribution: Europe, Orient, India, introduced in many other regions.

Melilotus officinalis Descr. in Lam. Dict. iv, 63.
Locality: *N.W.*: Near Miram Shah Fort, rocky bank of Chasmai River, (B. & F. 324 !).
Flowers & Fruit: 24-3-30 (Chasmai River).
Distribution: Europe, Orient, Siberia.

Melilotus messanensis (L.) Desf. Fl. Atl. ii (1798) 192.
Locality: *N.W.*: Razani (F. 2910 !).
Distribution: Mediterranean, Mesopotamia.

Melilotus dentatus Pers. Ench. ii, 348.
Vernacular name: Spestlarie (Waziri).
Locality: *N.W.*: Razani (F. 2137 !).—W. of Spinwam Fort, boulder and gravel slope of Chota Darweshta, 2,750-3,000 ft. (B. & F. 712 !).

Flowers & Fruit: 2-4-30 (Chota Darweshta).
Distribution: Europe, Caucasus, Siberia, Dahuria.

Melilotus elegans Salzmann in DC. Prodr. ii, 188.
Locality: *N.W.*: Datta Khel village, 4,600 ft. (B. & F. 1508 !).
S.W.: Razmak (F. 3204 !).
Flowers & Fruit: 17-4-30 (Datta Khel).
Distribution: Europe, Mediterranean, Abyssinia.

Melilotus neapolitanus Ten. Fl. Nap. Prodr. Suppl. i, 56.
Locality: *N.W.*: Khajuri Post, bed of Tochi River, 2,250 ft. (B. & F. 424 !).
Flowers & Fruit: 26-3-30.
Distribution: Mediterranean, Abyssinia, Orient.

Melilotus sulcatus Desf. Fl. Atl. ii (1798) 193.
Vernacular name: Speshterai (Waziri).
Locality: *N.W.*: Miram Shah, in fields (F. 829 !).
Flowers & Fruit: 16-4-27.
Distribution: Europe, Mediterranean.

Melilotus sp.
Vernacular name: Spetlarai, Peshlarai (Waziri).
Locality: *N.W.*: Razani, cultivated fields.
Uses: Eaten as greens.

MEDICAGO Tourn. ex L.

50 species.—Europe, Mediterranean, S. Africa.

Medicago sativa L. Sp. Pl. (1762) 1096.
Locality: Waziristan (Duthie's Collect. 15757).
N.W.: Miram Shah Fort, 3,150 ft. (B. & F. 972 !).
S.W.: Pre Ghal (Hay).
Distribution: Mediterranean, Europe, cultivated elsewhere.
Uses: Grown for fodder.

Medicago arabica All. Fl. Pedem. i (1785) 315.—*M. maculata* Willd. Sp. Pl. iii, 1412.
Locality: *N.W.*: Dwa Warkha (Stewart).
Distribution: Persia, Mediterranean, Europe.

Medicago lupulina L. Sp. Pl. (1753) 1097.
Vernacular name: Tervikai, Spesta (Waziri).
Locality: *N.W.*: Razani (F. 2219 ! 2863 !).
S.W.: To Razmak (Stewart); Razmak (F. 1730 !), on gravel slope and long stream, 6,300 ft. (F. 1996 !).—N. of Razmak, stony plain, 6,300 ft. (F. 1659 ! 2313 ! 2458 !).—W. of Razmak, stony plain, 6,800 ft. (B. & F. 1738 !).—Sararogha (F. 4424 !).
Flowers & Fruit: 23-4-27 (Razani); 24-4-30, 30-4-27, 7-5-27 (Razmak); 18-5-27 (Sararogha).
Distribution: Afghanistan, Orient, Abyssinia, Mediterranean, Europe, temperate Asia.

Medicago hispida (Gaertn.) Urban in Monogr. Medicago in Verh. Bot. Ver. Prov. Brandbg. xv (1873) 74.—*M. denticulata* Willd. Sp. Pl. iii, 1415; Boiss. Fl. Or. ii, 102.
Vernacular name: Malkondae, Malkendi (Waziri).
Locality: *N.W.*: Razani (Stewart).—Near Miram Shah, cultivated field on bank of Chasmai River, 3,150 ft. (B. & F. 223 ! 334 !).—Near Datta Khel village on gravel, 4,600 ft. (B. & F. 1483 ! 1501 ! 1511 !).—Near Miram Shah village, bed of Tochi River in gravel and sand (B. & F. 498 ! 516 !).—Spinwam Fort, forming pure formations on sand in Kaitu River, also infesting cultivation (B. & F. 444 !).—4 miles N.-E. of Datta Khel, in shade of trees (B. & F. 603 !).—Boya (F. 1167 !).—Datta Khel (F. 1199 ! 1249 !).—N. of Miram Shah village, clayey bank of irrigation channel, 3,150 ft. (B. & F. 465a !).
Flowers: 24-3-30 (Chasmai River); 25-3-27 (Datta Khel); 27-3-30 (Spin-

wam); 28-3-30 (Miram Shah village); 5-4-27 (Boya); 5-4-30 (Shewa Post); 17-4-30 (Datta Khel).

Distribution: Baluchistan, Afghanistan, Arabia, Egypt, Eritrea.

Uses: Eaten as greens, cooked with meat and eaten (F.).

Medicago hispida var. apiculata Blatter.—*Medicago apiculata* Willd. Sp. Pl. iii, 1414.

Vernacular name: Malakindai (Waziri).

Locality: *N.W.*: Near Boya Fort, bed of Tochi River, 3,650 ft. (B. & F. 97).

Flowers & Fruit: 21-3-30.

Distribution: Egypt, Syria, Mesopotamia, Persia.

Medicago pseudogranatensis Blatter *sp. nov.* [*Papilionacea. Affinis M. granatensi* Willd. *a qua distinguitur foliolis infra parce hirsutis stipulis obliquis profunde pinnatifido dentatis, pedunculis aristatis, leguminis facie non reticulato-nervosa.*]

Annua. Caules glabri graciles ad 30 cm. alti. Folia ad 17 mm. longa. Foliola obovato-cuneiformia apice truncata vel emarginata, tertia parte superiore denticulata 7 mm. longa apice 4 mm. lata infra parce appresse pilosa supra glabra. Stipulae obliquae profunde pinnatifido-dentatae, ad 3 mm. longae. Pedunculi 1-2-flori, aristati, foliis aequilongi. Flores flavi ca. 4 mm. longi. Calyx parce hirsutus 3 mm. longus, tubus segmentis longior, segmenta 1 mm. longa, lanceolata. Legumen discoideo-compressum, glabrum, laeve cinereum utrinque planum 4 mm. diam. inclusis spinis 7 mm.; spirae 5-6 laxiusculae laeves, facie non reticulato-nervosae, margine obtuso utrinque sulcato disticho spinigerae; spinae conico-subulatae hamosae erectae in parte inferiore bicrures crure posteriore e nervo margini parallelo oriundo.

An annual herb. Stems glabrous, slender, up to 30 cm. high. Leaves up to 17 mm. long, petioles sparingly pilose. Leaflets cuneiform-obovate, truncate or emarginate at the apex, denticulate in the upper third, 7 mm. long, at the apex, 4 mm. broad, below sparingly appressedly pilose on the upper surface glabrous, petiolules pilose. Stipules oblique, deeply pinnatifid-dentate, up to 3 mm. long. Peduncles 1-2-flowered, awned, as long as the leaves. Flowers yellow, about 4 mm. long. Calyx sparingly hirsute, 3 mm. long, tube longer than the segments; segments 1 mm. long, lanceolate. Pod discoid-compressed, glabrous, smooth, grey, flat on both sides, 4 mm. diam., including the spines 7 mm., face not reticulated-veined; spirals 5-6, somewhat lax, margin obtuse, on both sides sulcate, distichously spine-bearing; spines conico-subulate, hooked, erect, sulcate towards the base, the posterior part arising from a nerve parallel to the margin.

Locality: *N.W.*: Near Miram Shah, left bank of Chasmai River, 3,150 ft. (B. & F. 320 ! type), near Miram Shah, bed of Chasmai River, on gravel with sand, 3,100 ft. (B. & F. 251 !).—Plain E. of Miram Shah Fort, on sand near water, 3,150 ft. (B. & F. 120 !).—Near Shewa Post, left bank of Volam River, on gravel (B. & F. 871 !).

Flowers & Fruit: 24-3-30 (Miram Shah); 5-4-30 (Shewa Post).

Medicago monantha Blatter *sp. nov.* [*Papilionacea. Valde affinis M. pseudogranatensi* Blatter *sed facile distinguitur pedunculis unifloris foliis brevioribus.*]

Quadrat in omnibus pedunculo excepto eum specie cui est affinis. Loco diagnosis reiterare opportet integram descriptionem speciei M. pseudogranatensis supra datam. Verba 'Pedunculi 2-flori . . . foliis aequilongi' delenda sunt in quorum loco inserere placebit: 'Pedunculi uniflori foliis multo brevioribus.'

Non sum ignarus nomen M. monanthae prius (1841) *datum fuisse a cl. Trautvettero sed planta quam refert ad genus pertinet. Trigonellae.*

This new species agrees in every detail with *M. pseudogranatensis* Blatter except that the peduncles are 1-flowered and much shorter than the leaves.

Locality: *N.W.*: W. of Spinwam Fort, in sandy plain, 2,650 ft. (B. & F. 839 ! type).—E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 660 ! cotype).

Flowers & Fruit: 1-4-30; 4-4-30.

Medicago sp. near *M. laciniata* All.

For want of fruit indeterminable.

Locality: *N.W.*: Boya, 3,400 ft. (F. 1167 !).
Flowers: April.

LOTUS (Tourn.) L.

15 species.—Temperate Europe, Asia, S. Africa, Australia.

Lotus corniculatus L. Sp. Pl. (1753) 1092.
Locality: *N.W.*: Shakai, 6,700 ft. (Duthie's Collect. 15651 !).
S.W.: Wana (F. 3648 !).
Flowers: 30-4-1895 ! (Shakai); 15-6-27 (Wana).
Distribution: Europe, N. Asia, Orient, Afghanistan, India on hills, Japan, Abyssinia, New Holland.

Lotus angustissimus L. Sp. Pl. (1753) 171.
Locality: *N.W.*: Dwa Warkha (Stewart).
Distribution: Mediterranean, Europe, Orient, Soongaria, Siberia.

Lotus Gebelia Vent. Hort. Cels. t. 57, **var genuinus** Boiss. Fl. Or. ii (1872) 168.
Locality: *N.W.*: Near Miram Shah Fort, bed of Chasmai River, clayey soil, 3,100 ft. (B. & F. 242 ! 242a ! 242b !).
Flowers & Fruit: 23-3-30.
Distribution: Mediterranean, Orient, to Persia.

Lotus sp.
Folia minima, carnosa. Legumina cylindrica, glabra, 2.5 cm. longa. Semina 10. Flores desunt.
Locality: *S.W.*: Wana, S.-E. of Camp (F. 3643 !).
Fruit: 15-6-27.

INDIGOFERA L.

350 species.—Warm regions.

Indigofera oblongifolia Forsk. Fl. Aeg.-Arab. (1775) cxviii, no. 455, p. 137.—*I. paucifolia* Del. Fl. d'Eg. (1812) 251.
Vernacular name: Sussa (Waziri).
Locality: *N.W.*: Miram Shah, among rocks, 3,140 ft. (F. 389 ! 1406 ! 1407 ! 1459 !).
S.W.: Tenai Post, open stony ground (F. 3810 ! 3821 !).—Dargai Post (F. 4082 !).—Spin (F. 3856 !).
Distribution: India, Ceylon, Baluchistan, Arabia, Java, tropical.

Indigofera acanthinocarpa Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 482.
Locality: *S.W.*: Dargai Post, open stony ground (F. 4066 ! 4075 !).—Tenai Post, stony ground (F. 4030 !).
Flowers & Fruit: 22-6-27 (Dargai Post).

*ROBINIA Linn.

6 species.—N. America.

*** Robinia Pseud-acacia** Linn. Sp. Pl. (1753) 722.
Vernacular name: False Acacia, Robinia, Black Locust.
Locality: *N.W.*: Miram Shah, cultivated (B. & F. 645a !).
Flowers: 30-3-30 (Miram Shah).
Distribution: Indigenous in the United States.

CARAGANA Lam.

40 species.—Central Asia, China.

Caragana acaulis Baker in Journ. Linn. Soc. xviii (1881) 44.
Locality: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15648 !).
Flowers: 30-4-1895 (Shakai).
Distribution: Afghanistan.

Caragana brevispina Benth. in Royle. Ill. 198.
Locality: *Waziristan* (Duthie's Collect. 15708 !).
Distribution: Temperate W. Himalaya, Afghanistan, Chinese Tartary.

Caragana Gerardiana Royle. Ill. 198, t. 34; f. 1.
Vernacular name: Ghad zariae.
Locality: *S.W.*: Shuidar, on top, 10,900 ft. (F. 2496 ! 4461 !).—Pre Ghal (Duthie's Collect. 15596 !).
Flowers: 8-5-27 (Shuidar); 19-5-1895 (Pre Ghal).
Distribution: Temperate and alpine W. Himalaya, Garhwal, Kumaon, Kunawar.

Caragana ulicina Stocks in Hook. Journ. iv, 145.
Locality: *N.W.*: Miram Shah, open stony ground, 3,000 ft. (F. 484 !).
S.W.: Sarwekai, 3,200 ft. (F. 3999 ! 4004 !).—Sararogha, dry nalas, W. of Camp and along dry stony slopes of the nala area, 4,000 ft. (F. 581 ! 599 !).
Waziristan, 2,000-8,000 ft. (Brandis, in MS.).
Flowers: May.
Distribution: Baluchistan.

Caragana spinosissima Blatter in Journ. Ind. Bot. Soc. ix (1930) 205 (*non* Benth. *quae est C. Gerardiana* Royle.).
Vernacular name: Makhai (Waziri).
Locality: *N.W.*: Boya, open stony ground along foot of hills, 4,000 ft. (F. 907 ! 910 ! 913 !).
Flowers: March.
Distribution: Endemic.

Caragana ambigua Stocks in Hook. Journ. iv, 145; Boiss. ii (1872) 199.
Locality: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15687 !).
S.W. (Duthie's Collect. 15613).
Flowers: 30-4-1895 (Shakai).
Distribution: Baluchistan.

ASTRAGALUS Tourn. ex L.

1,600 species.—Cosmopolitan, with the exclusion of Australia.

Astragalus polyacanthus Royle Ill. 199.
Vernacular name: Zariae (Waziri).
Locality: *N.W.*: N. of Dossali Fort, stony nala, 4,900 ft. (B. & F. 1271 !).—2 miles above Dossali Fort, 5,100 ft. (B. & F. 1113 !).—N. of Dossali in nala called Rosh, 4,900 ft. (B. & F. 1028 !).—Razmak Narai, in ravine, 7,000 ft. (B. & F. 1235 !).
Flowers: 10-4-30 (Dossali); 14-4-30 (Razmak Narai); 15-4-30 (Dossali).
Distribution: N.-W. India, Kumaon, Garhwal, Afghanistan.

Astragalus polyacanthus var. villosa Blatter *var. nov.*
Foliola inferne villosa. Calyx villosulus. Pedicelli villosissimi.
Locality: *N.W.*: Shewa Post, left bank of Volam River, 2,150 ft. (B. & F. 887 !).
Flowers & Fruit: 5-4-30.

Astragalus Stocksii Benth. ex Bunge Monogr. Astrag. (1868-69) pt. 1, 6, pt. 2, 4.
Vernacular name: Zariae, Spinkaya ackzai (Waziri).
Locality: *N.W.*: Miram Shah, among rocks, 3,140 ft. (F. 1406 !).—Datta Khel (B. & F. 593 ! 1348 ! 1658 !).—Boya (F. 559 ! 1433 !).
S.W.: Sarwekai, 3,500 ft. (F. 3990 !).—Wana (F. 3574 !), N.-E. of Camp on lower slopes and in stony plain, 4,500 ft. (F. 3874 !).—Tenai (F. 4022 !).—Tenai Post, fairly common, 3,200 ft. (F. 3815 !).—Barwand, 4,000 ft. (Duthie's Collect. 15729 !).
Flowers & Fruit: March, April.
Distribution: Baluchistan, Afghanistan.

Astragalus polemius Boiss. Fl. Or. ii (1872) 306.
Vernacular name: Levokota, Sessai.

Locality: *N.W.*: Razani, 5,000 ft. (F. 2089 ! 2090 ! 2206 ! 2856 ! 3004 !).—Miram Shah (F. 450 !).—Shakai, 6,000-7,000 ft. (Duthie's Collect. 15684 ! 15685 !).
S.W.: Kaniguram, 6,500 ft. (Duthie's Collect. 15756 !).—Razmak, on hill (B. & F. 1913 !).
Flowers: April, 25-4-27 (Razani); 30-4-1895 ! (Shakai); 14-5-1895 (Kaniguram).
Distribution: Baluchistan.

Astragalus infestus Boiss. Diagn. ser. 1, ix, 95.
Locality: *N.W.*: Razani (F. 2089 ! 2090 !).
Flowers: 20-4-27 (Razani).
Distribution: Afghanistan.

Astragalus stipitatus Benth. in Griff. Cat. 1504; Boiss. Fl. Or. ii (1872) 305.
Locality: *N.W.*: Razani (F. 2856 !).
Flowers: 19-4-27 (Razani.)
Distribution: Afghanistan.

Astragalus lasiosemius Boiss. Diagn. ser. 1, ix, 96.
Locality: *N.W.*: W. of Spinwam Fort, Chota Darweshta, 3,000-4,800 ft. (B. & F. 734 !).
Flowers: 2-4-30 (Spinwam).
Distribution: Afghanistan.

Astragalus tribuloides Del. Fl. Aegypt. Ill. 70 (*non* Kotzschy).
Locality: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15661).—Kaniguram (Stewart).
Flowers: 4-5-1895 (Wana).
Distribution: Punjab Plains, Afghanistan to the Canaries.

Astragalus raphiodontus Boiss. Diagn. ser. 1, 9, 96.
Locality: *Tank*: Near Tank (J. Williams 9208 !).
Fruit: 30-7-1888 (Tank).
Distribution: Afghanistan.

Astragalus anisacanthus Boiss. Diagn. ser. 1, ix, 129.
Vernacular name: Makhai, Zariae (Waziri).
Locality: *N.W.*: Boya (F. 1466 ! 1467 !).—Datta Khel (F. 1286 !).—Miram Shah (F. 443 ! 447 !).
S.W.: Barwand, 4,000 ft. (Duthie's Collect. 15636 !).
Flowers & Fruit: 29-4-1895.
Distribution: Afghanistan, Baluchistan.

Astragalus congestus Baker ex Aitch. in Journ. Linn. Soc. xix (1882) 158.
Locality: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15688 !).—Razani (F. 2075 ! 2085 !).
S.W.: Kaniguram, 6,300 ft. (Duthie's Collect. 15758 !).—Razmak (F. 1845 ! 2021 ! 2032 ! 2045 ! 2416 ! 3046 ! 3107 !).
Tank (J. Williams 9209 !).
Flowers: 30-4-1895 (Shakai); 1-8-1888 (Tank).
Fruit: 14-5-1895 (Kaniguram).
Distribution: India.

Astragalus camporum Benth. ex Bunge Astrag. ii, 3.
Vernacular name: Makhai, Vojhakai (Waziri).
Locality: *N.W.*: Near Miram Shah Fort, bed of Chasmai River, 3,100 ft. (B. & F. 276 !).—2 miles above Dossali Fort, right bank of Khunai River, 5,150 ft. (B. & F. 1133 ! 1187 !).—Razani (F. 2145 ! 2980 !), along stream (F. 2981 !).
S.W.: Wana, 4,500 ft. (Duthie's Collect. 15628 !).—Razmak (F. 3295 !), on stony ground, carpeting (F. 1909 !).—W. of Razmak Camp, stony plain (B. & F. 1741 !).—Slopes of Shuidar, grassland (F. 1585 !).
Flowers & Fruit: 23-3-30 (Chasmai River); 12-4-30 (Dossali); 23-4-27 (Razani); 24-4-30 (Razmak); 1-5-1895 (Wana); 5-5-27 (Razmak).
Distribution: Afghanistan, Baluchistan.

Astragalus eremophilus Boiss. Diagn. ser. i, 2, 54.

Locality: *N.W.*: N. of Dossali Fort, nala (B. & F. 1023 !).—Shewa Post, right bank of Kuram River (B. & F. 874 ! 931 !).
Flowers & Fruit: 5-4-30 (Shewa Post); 10-4-30 (Dossali).
Distribution: Baluchistan, Arabia, Egypt.

Astragalus amherstianus Benth. in Royle. Ill. 199.
Vernacular name: Gulakai (Waziri).
Locality: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1343 !).—Boya (F. 901 !).—E. of Miram Shah Fort, stony plain, 3,150 ft. (B. & F. 128 !).—Near Miram Shah, bed of Chasmai River, 3,100 ft. (B. & F. 265 ! 277 !).—Shewa Post, right bank of Kuram River (B. & F. 937 !).
Flowers & Fruit: 22-3-30 (Miram Shah); 27-3-27 (Boya); 5-4-30 (Shewa Post); 16-4-30 (Datta Khel).
Distribution: Afghanistan, N.-W. Himalaya.

Astragalus subumbellatus Klotzsch in Reise. Pr-Wald. Bot. 159, t. 3.
Locality: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15697 !).—2 miles above Dossali Fort, 5,100 ft. (B. & F. 1112 !).—Razani (F. 2211 ! 2573 !).—Razmak Narai, slope of ravine, 7,000 ft. (B. & F. 1207 !).—Loargai Narai (B. & F. 1325 !).
S.W.: Razmak (F. 1808 !).
Tank: Near Tank (J. Williams !).
Flowers: 12-4-30 (Dossali); 16-4-30 (Loargai Narai); 23-4-27 (Razani); 30-4-1895 (Shakai); 10-5-27 (Razmak).
Distribution: Punjab, Hazara, Kashmir up to 6,000-7,000 ft., Baluchistan, Afghanistan.

Astragalus lasius Blatter in Journ. Bomb. Nat. Hist. Soc. xxxvi (1933) 480.
Locality: *N.W.*: Below Spinwam Fort, banks of Kaitu River in grassland 2,600 ft. (B. & F. 754 !).—Near Miram Shah, bed of Chasmai River, on gravel and sand, 3,100 ft. (B. & F. 261 !).
Flowers & Fruit: 23-3-30 (Miram Shah); 2-4-30 (Spinwam).

Astragalus Fernandezianus Blatter in Journ. Bomb. Nat. Hist. Soc. (1933) 482.
Vernacular name: Siringai (Waziri).
Locality: *N.W.*: Alexandra Picket, above Razani, 8,000 ft. (B. & F. 1261 !).
S.W.: Razmak, 6,800 ft. (F. 3174 ! 3278 ! 3279 ! 3113 !).

Astragalus sp.—*aff. A. psilacanthus* Boiss.
Locality: *N.W.*: Miram Shah (F. 456 !).

Astragalus sp.—*Flores lilacini laxe racemosi, stigmate barbatulo; pedunculi ad 10 cm. longi. Legumen non visum.*
Locality: *S.W.*: E. of Razmak Camp, slope of hill, above 6,800 ft. (B. & F. 1910 !).
Flowers: 26-4-30 (Razmak).

Astragalus sp. *aff. A. Candolleanus* Royle.
Locality: *S.W.*: Sararogha (F. 585 ! 612 !).

Astragalus sp. *Sect. Myobromae* Bunge.—*Calyx quadruplo corolla brevior, dentes obscuri.*
Locality: *S.W.*: Razmak, 6,800 ft. (F. 2343 !).
Flowers: 7-5-27.

OXYTROPIS DC.

175 species.—North temperate regions.

Oxytropis *aff. polyphylla* Ledeb.
Locality: *S.W.*: Razmak, open stony plain (F. 2719 !).
Flowers: 29-4-27 (Razmak).

TAVERNIERA DC.

7 species.—N. Africa, W. Asia.

Taverniera cuneifolia Arn. in Wight Ic. t. 1055.—*T. nummularia* Baker in Hook. f. Fl. Brit. Ind. ii, 140 (*partim, non* DC).

Locality: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15699 !).
Tank: At and near Tank (J. Williams !).
Flowers: 30-4-1895 (Shakai); 31-5-1891 (Tank).
Distribution: Bombay Presidency, Sind, Baluchistan, Persian Baluchistan.

EBENUS L.

14 species.—Mediterranean to India.

Ebenus stellata Boiss. Diagn. ser. 1, ii (1843) 100.—*E. tragacanthoides* Jaub. & Sp. Ill. Or. iii, 158, t. 254.—*E. horrida et E. ferruginea* Jaub. & Sp. l.c. 159, 160.
Vernacular name: Khara zariae (J. Williams); Khada sussai (in Waziri).
Locality: *N.W.*: Datta Khel, Son Khel, 6,000-7,000 ft. (Duthie's Collect. 15761 !).—Shakai, 6,000-7,000 ft. (Duthie's Collect. 15690 !).—Boya (F. 1491 !).—Razani (F. 2091 ! 2631 ! 2633 ! 2638 ! 2639 ! 2643 !).—Miram Shah (F. 430 ! 485 !).—Datta Khel (F. 1293 ! 1294 !).
S.W.: Sararogha (F. 62 ! 90 !).—Wana (F. 3601 !).
Tank: Near Tank (J. Williams 9211 !).
Distribution: Punjab Himalaya, 4,000-8,000 ft., Baluchistan, Afghanistan, Persia, Arabia.

ONOBRYCHIS L.

100 species.—Europe, Mediterranean, Asia.

Onobrychis dasycephala Baker in Journ. Linn. Soc. xviii (1886) 48.
Locality: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15645 !).
Flowers: 30-4-1895 (Shakai).
Distribution: Afghanistan.

ALHAGI Tourn. ex Adans.

3 species.—Mediterranean, W. Asia.

Alhagi camelorum Fisch. Ind. Hort. Gorenk. ed. 2 (1812) 72.—*A. maurorum* Stewart (1869) 57; Baker in Hook. f. Fl. Brit. Ind. ii (1876) 145 (*non* Tourn.).
Vernacular name: Tandan, Tandah, Tundunh (Waziri); Camel Thorn.
Locality: *N.W.*: Boya, open stony ground and in gravelly fields, 4,000 ft. (F. 1048 !).—Neighbourhood of Datta Khel Fort (B. & F. 1443 !).—Miram Shah, stony ground and also here and there in fields, 3,000 ft. (F. 878 !, B. & F. 225 !).
S.W.: Sarwekai, stony ground, 3,200 ft. (F. 3896 !).—Jandola, dry open ground and dry slopes of Tank River, 2,200 ft. (F. 785 !).—Wana, open stony plain, 4,500 ft. (F. 3489 !).—Tenai Post, common all over on slopes and stony plains, 3,200 ft. (F. 3811 !).—Spin, forming pure formation on stony plain (F. 3827 ! 3850 !).—Dargai Post, stony slopes (F. 3740 ! 3741 !).
Tank (Stewart).
Flowers: May, June.
Fruit: June.
Distribution: From Greece and Egypt through Arabia, Persia, Afghanistan, Baluchistan, N.-W. India, Sind, Rajputana Desert.

VICIA Tourn. ex L.

150 species.—N. temperate regions, S. America.

Vicia sativa L. Sp. Pl. 736.
Vernacular name: Common Vetch, Tare.
Locality: *N.W.*: Upper region (Stewart).
Tank (J. Williams 7138 !).
Fruit: 5-5-1888 (Tank).
Distribution: Wild in Europe, introduced into India.

Vicia sepium L. Sp. Pl. (1753) 1038.
Locality: *N.W.*: Miram Shah Fort, Officer's garden, 3,150 ft. (B. & F. 643 !).—Near Miram Shah, left bank of Chasmai River (B. & F. 328 !).
Flowers & Fruit: 24-3-30 (Chasmai River); 31-3-30 (Miram Shah).
Distribution: Europe, Orient, Siberia.

Vicia peregrina L. Sp. Pl. (1753) 737.
Vernacular name: Pereikesai (Waziri).
Locality: *N.W.*: Miram Shah, 3,150 ft. (F. 830 !), Officer's garden, 3,150 ft. (B. & F. 642 !).
S.W.: Sararogha (F. 24 !).
Flowers: 31-3-30; 16-4-27 (Miram Shah).
Fruit: 13-3-30 (Miram Shah); 16-4-27; 18-5-27 (Sararogha).
Distribution: Punjab Plains, Europe, Orient.

Vicia angustifolia Roth. Tent. Fl. Germ. i (1788) 310.
Locality: *N.W.*: Bed of Tochi River near Miram Shah village, 3,150 ft. (B. & F. 507 !).—Datta Khel Fort, Scouts' garden, 4,600 ft. (B. & F. 1390 !).
Flowers: 17-4-30 (Datta Khel).
Flowers and unripe fruit: 28-3-30 (Miram Shah).
Distribution: Europe, W. Africa, Orient to Afghanistan.

Vicia angustifolia Roth. **var. ⌜pusilla⌟** Boiss. Fl. Or. ii (1872) 575.—*Foliola apice mucronata.*
Locality: *N.W.*: E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 679 !).
Flowers & Fruit: 1-4-30 (Spinwam).

Vicia calcarata Desf. Fl. Atl. ii, 166; Boiss. Fl. Or. ii (1872) 590.
Vernacular name: Kiassa (Waziri).
Locality: *N.W.*: Razani (F. 2202 !).
Flowers & unripe Fruit: 23-4-27.
Distribution: Mediterranean, Orient.

Vicia sp. *affinis V. iranicae* Boiss. (*Flores carneae, deinde cyaneae*).
Locality: *N.W.*: Right bank of Chasmai River (near Miram Shah), 3,100 ft. (B. & F. 327 ! 340 !).
Flowers & unripe fruit: 24-3-30.

Vicia sp. *affinis V. villosae* Roth. (*Flores carneae*).
Vernacular name: Margaibpsha (Waziri).
Locality: *N.W.*: Boya (F. 1052 !).
Flowers & Fruit: 28-3-27.

Vicia sp.—*Pedunculus uniflorus brevissimus; stipulae laciniatae. Folia* 3-*juga, ecirrhifera. Foliola inferiora obovata. Calyx regularis. Stylus apice circumcirca hirsutus.*
Locality: *N.W.*: Boya (F. 1055 !).
Flowers & unripe fruit: 28-3-27.

Vicia sp.—*Flores coerulei* 13 *mm. longi; pedunculi* 1-3-*flori, ca.* 2 *cm. longi. Folia ramose cirrhifera; generatim* 7-*juga. Stylus sursum circumcirca hirsutus. Stipulae bipartitae, unum segmentum laciniatum. Calyx irregularis.*
Vernacular name: Margaibsha (Waziri).
Locality: *N.W.*: Boya, in cultivated fields and along water channels (F. 1153 !).
Flowers & unripe fruit: 5-4-27.

Vicia sp. *Foliola* 4-5-*juga. Folia racemose cirrhifera. Calyx regularis paullum corolla brevior.*
Vernacular name: Mait (Waziri).
Locality: *N.W.*: Datta Khel (F. 1299 !).
Flowers: 25-3-27.

Vicia sp. *Folia* 8-*juga, cirrhus simplex. Foliola anguste linearia, apice acuta. Calyx irregularis corolla triplo brevius.*
Locality: *N.W.*: Boya, cultivated fields (F. 1176 !).
Flowers: 5-4-27.

Vicia sp.—*Folia* 7-10-*juga; cirrhus racemosus. Stipulae bipartitae, segmenta lanceolata. Stylus ad latus inferius apicis barbatus.*
Locality: *N.W.*: Boya (F. 1037a !).
Young fruit: 28-3-27.

Vicia sp. *Folia* 4-5-*jugata, racemose cirrhifera. Stipulae bipartitae profunde dentatae.*

Locality: *N.W.*: Near Miram Shah, on gravel, right bank of Chasmai River, 3,100 ft. (B. & F. 227 !).

LATHYRUS (Tourn.) L.

115 species.—N. temperate regions and mountains of tropical Africa and S. America.

Lathyrus aphaca L. Sp. Pl. 729.
Vernacular name: Lakai, Rogopsha, Margatel (Waziri).
Locality: *N.W.*: Dwa Warkha (Stewart).—Lower slope of the nearest hills E. of Spinwam Fort, 2,600 ft. (B. & F. 762 !).—Datta Khel village, 4,600 ft. (B. & F. 1235 ! 1512 !).—Boya (F. 1142 !).—Chasmai River, right bank, 3,100 ft. (B. & F. 326 !).—Dossali Fort stony plain, 4,900 ft. (B. & F. 1276 !).
Flowers: 24-3-30 (Chasmai); 3-4-30 (Spinwam); 5-4-27 (Boya); 15-4-30 (Spinwam); 17-4-30 (Datta Khel).
Distribution: Throughout N. India, up to 7,600 ft., W. Asia, N. Africa, Europe.

Lathyrus inconspicuus L. Sp. Pl. (1753) 730.—*L. erectus* Lag. Gen. & Sp. Nov. 22; Boiss. ii, 613.
Locality: *Tank*: Near Tank (J. Williams !).
Flowers: 29-5-1888 (Tank).
Distribution: Sind, Baluchistan, Kashmir, Punjab, Afghanistan, Orient, S. Europe.

***Lathyrus odoratus** L. Sp. Pl. 732.
Vernacular name: Sweet Pea.
Locality: *N.W.*: Miram Shah (B. & F. !).
Distribution: Italy. Cultivated everywhere.

PHASEOLUS (Tourn.) L.

160 species.—Tropics and warm temperate regions.

Phaseolus aconitifolius Jacquin Obs. Bot. pars 3 (1768) 2, t. 52.
Vernacular name: Mong.
Locality: *Tank*: Near Tank (J. Williams 7132 !).
Flowers: 21-5-1888 (Tank).
Distribution: Himalayas to Ceylon.

Phaseolus sp.
Locality: *S.W.*: Jandola, open stony ground and nalas (F. 673 !).

RHYNCHOSIA Lour.

120 species.—Tropical and subtropical regions.

Rhynchosia minima DC. Prodr. ii (1825) 385.
Vernacular name: Praweti.
Locality: *S.W.*: Pass of Zam (J. Williams 7799 !).
Tank (J. Williams 7140a ! 7140bis !).
Flowers: 11-5-1888 (Tank).
Fruit: 27-6-1888 (Zam).
Distribution: Throughout India, Ceylon, tropics generally.

DALBERGIA L. f.

120 species.—Warm regions.

Dalbergia Sissoo Hort. Beng. (1814) 53.
Vernacular name: Shewa (Pu.).
Locality: *S.W.*: Jandola, planted in fields, on the Zam River, 2,200 ft. (F. 745 ! 788 !).—Valley of Zam above Khirgi, common (Stewart).
Fruit: May.
Distribution: Kuram Valley, Baluchistan, sub-Himalayan tract and in the outer valleys from the Indus to Assam, up to 5,000 ft. Planted and selfsown all over India.

SOPHORA L.

25 species.—Tropics and warm temperate regions.

Sophora Griffithii Stocks in Hook. Kew Journ. Bot. iv (1852) 147.—*Keyserlingia Griffithii* Boiss. Fl. Or. ii (1872) 630.
Vernacular name: Vojair, Gojair.
Locality: *N.W.*: Razani, 5,000 ft. (F. 2199 ! 2204 ! 2855 ! 2857 ! 2998 ! 3002 ! 3005 !).—Miram Shah, 3,500 ft. (F. 381 ! 413 !).
S.W.: Wana, on hills, N.-E. of Camp, about 4,800 ft. (F. 3440 ! 3441 ! 3444 ! 3559 ! 3560 ! 3653 ! 3687 ! 3697 ! 3888 !).—Razmak, stony plain, 6,500 ft. (F. 2001 !).—Sararogha, few plants found, 4,000 ft. (F. 189 ! 197 ! 202 ! 205 !).—Sarwekai, near Old Sarwekai Fort, in open plain (F. 3451 !).
Flowers: April.
Distribution: Persia, Afghanistan, Baluchistan, Salt Range.

Sophora mollis Grah. in Wall. Cat. (1828) no. 5335.—*Edwaria mollis* Royle Ill. t. 32, fig. 2.
Vernacular name: Vojair, Gojair (Waziri); Gorja.
Locality: *N.W.*: Miram Shah, among high hills, about 3,500 ft. (F. 378 ! 495 ! 1396 ! 1405 ! 1411 ! 1416 ! 1417 !).—Boya, on high hills S. of the Post, about 4,500 ft. (F. 550 !).—Razani, 5,000 ft. (F. 2060 ! 2074 ! 2092 ! 2194 ! 2200 ! 2208 ! 2853 !).—W. of Spinwam Fort, Chota Darweshta, 3,000-4,800 ft. (B. & F. 725 !).—N. of Dossali, stony plain and nalas, 4,900 ft. (B. & F. 992 !).—Razmak Narai, ravine, 7,000 ft. (B. & F. 1250 !).
S.W.: Razmak, open stony ground, 6,500 ft. (F. 1870 ! 1871 ! 1891 ! 2026 ! 2249 ! 2319 ! 2321 ! 2322 ! 2656 ! 2791 ! 3062 ! 3070 ! 3079 ! 3081 ! 3087 ! 3208 ! 3216 ! 3219 ! 3227 !).—Above Palosina (Stewart).—Near Kaniguram, about 8,200 ft. (Stewart).—Wide shingle plateau of Tandachina (Stewart).—On a spur of the Pre Ghal (Stewart).—Pre Ghal (J. Williams 7803 !).
Flowers: 2-4-30 (Spinwam); 14-4-30 (Razmak Narai).
Fruit: 10-4-30 (Dossali); 1-8-1888 (Pre Ghal).
Distribution: Afghanistan, Kuram Valley, Baluchistan, Salt Range, N.-W. Himalaya as far as Nepal, ascending to 6,000 ft.

HALIMODENDRON Fisch. ex DC.

1 species.—N. and W. Asia, on salt steppes.

Halimodendron argenteum DC. Prodr. ii (1825) 269; Boiss. Fl. Or. ii (1872) 198.—*Robinia halodendron* L. f. Suppl. 330; Pall. Fl. Ross. t. 46.—*Caragana argentea* Lam. Encycl. i, 616.—*Halimodendron cuspidatum et emarginatum* Jaub. & Spach in Ann. Sc. Nat. xviii, 237.
Vernacular name: Zariai (Waziri).
Locality: *N.W.*: Razani, on stony slopes, 5,000 ft. (F. 2979 !).
S.W.: Razmak, 6,500 ft. (F. 2807 ! 3085 !), on stony ground (F. 2248 ! 2318 ! 2805 ! 3086 ! 3088 ! 3090 ! 3325 !).
Distribution: Persia, Turkestan, Soongaria, Siberia, Altaica.

GLYCYRRHIZA Tourn. ex L.

12 species.—Temperate and subtropical.

Glycyrrhiza glabra L. Sp. Pl. 1048.
Vernacular name: Called in the Punjab Mallati.
Locality: *N.W.*: Between Datta Khel and Boya, along water channel, 4,500 ft. (B. & F. 606 !).
Distribution: Europe, N. Africa, Orient, Afghanistan, Soongaria.

BAUHINIA L.

250 species.—Tropics.

***Bauhinia variegata** L. Sp. Pl. (1753) 375.
Locality: *N.W.*: Miram Shah Fort, 3,150 ft., in garden (B. & F. !).
Flowers: 28-3-30.
Distribution: Sub-Himalayan tract and Outer Himalaya, up to 4,000 ft. from the Indus eastwards to Burma, China.

(To be continued).

EARTH-EATING AND SALT-LICKING IN INDIA.

BY

J. F. Caius, s.j., f.l.s.

and

K. H. Bharucha, b.a., b.sc.

(*Pharmacological Laboratory, Parel, Bombay*).

ANALYSES XXVI-XXXI.

XXVI.—Soil from Salt-Lick.

Serial No. 157.

Locality—Two miles west of Nagerhole Forest Rest House, South Coorg.

Collected and sent by—G. Robinson Esqr., Chief Forest Officer, Mercara, Coorg.

Oak brown earth and hard clayish lumps with numerous rust brown spots. Powder rough and soapy.

Minerals	1.90	per cent.
Clay	18.00	,,
Sand	74.85	,,
Organic debris	0.70	,,
Moisture	3.80	,,
Fine Earth (20 mesh sieve)	95.240	,,
Insoluble in nitric acid	86.400	,,
Potash (K_2O)	3.986	,,
Magnesia (MgO)	0.154	,,
Lime (CaO)	0.168	,,
Alumina (Al_2O_3)	1.700	,,
Sulphur (SO_3)	0.015	,,
Phosphorus (P_2O_5)	0.459	,,
Manganese (Mn)	0.008	,,
Ferric oxide (Fe_2O_3)	1.430	,,
Moisture and organic matter	1.100	,,

Remarks:—1. The soil contains traces of humus, sodium, and soluble silica.

2. The lick is situated but a short distance from Salt-lick No. 156.

XXVII.—Soil from Salt-Lick.

Serial No. 13.

Locality—Banda Range, Banda Forest Division, United Provinces.

Collected and sent by—The Range Forest Officer, Banda Range, Banda, United Provinces.

Grey lumps and brownish grey earth with a few bits of straw and twigs. Powder soft.

Minerals	3.23	per cent.
Clay	30.48	,,
Sand	57.65	,,
Organic debris	0.82	,,
Humus	0.96	,,
Moisture	4.60	,,
Fine Earth (20 mesh sieve)	92.110	,,
Insoluble in nitric acid	77.006	,,
Soda (Na_2O)	1.623	,,
Potash (K_2O)	4.585	,,
Magnesia (MgO)	0.690	,,
Lime (CaO)	0.417	,,
Alumina (Al_2O_3)	2.932	,,
Silica (SiO_2) soluble	0.404	,,
Phosphorus (P_2O_5)	0.311	,,
Chlorine (Cl)	0.120	,,
Manganese (Mn)	0.068	,,
Ferric oxide (Fe_2O_3)	3.181	,,
Moisture and organic matter	2.400	,,

Remarks.—The soil contains traces of sulphur.

XXVIII.—Common Earth.

Serial No. 14.

Locality—Banda Range, Banda Forest Division, United Provinces.

Collected and sent by—The Range Forest Officer, Banda Range, Banda, United Provinces.

Greyish friable lumps with reddish brown streaks, and dark fawn earth; a few bits of straw and twigs. Powder rough.

Minerals	1.55	per cent.
Clay	16.86	,,
Sand	75.20	,,
Organic debris	1.51	,,
Humus	0.67	,,
Moisture	2.26	,,
Fine Earth (20 mesh sieve)	96.192	,,
Insoluble in nitric acid	85.000	,,
Potash (K_2O)	3.538	,,
Magnesia (MgO)	0.240	,,
Lime (CaO)	0.238	,,
Alumina (Al_2O_3)	2.378	,,
Silica (SiO_2) soluble	0.196	,,
Sulphur (SO_3)	0.020	,,
Phosphorus (P_2O_5)	0.238	,,

Manganese (Mn)	0.016	per cent.
Ferric oxide (Fe_2O_3)	1.966	,,
Moisture and organic matter	2.200	,,

Remarks:—1. The soil contains traces of sodium and chlorine.
2. The sample was taken from the forest adjoining Salt-Lick No. 13.

XXIX.—Soil from Salt-Lick.

Serial No. 20.
Locality—Reserve Forest, Kota Bilaspur Division.
Collected and sent by—The Divisional Forest Officer, Kota Bilaspur.

Buffy hard lumps. Powder soft.

Minerals	10.11	per cent.
Clay	20.80	,,
Sand	62.38	,,
Organic debris	1.32	,,
Moisture	3.10	,,
Fine Earth (20 mesh sieve)	86.790	,,
Insoluble in nitric acid	67.820	,,
Soda (Na_2O)	0.891	,,
Potash (K_2O)	4.219	,,
Magnesia (MgO)	0.965	,,
Lime (CaO)	0.513	,,
Alumina (Al_2O_3)	4.860	,,
Silica (SiO_2) soluble	1.814	,,
Sulphur (SO_3)	0.013	,,
Phosphorus (P_2O_5)	0.102	,,
Manganese (Mn)	0.024	,,
Ferric oxide (Fe_2O_3)	2.860	,,
Moisture and organic matter	2.794	,,

Remarks.—The soil contains traces of carbon dioxide.

XXX.—Common Earth.

Serial No. 21.
Locality—Reserve Forest, Kota Bilaspur Division.
Sent by—The Divisional Forest Officer, Kota Bilaspur.

Buffy hard clayish lumps. Powder soft.

Minerals	12.05	per cent.
Clay	16.04	,,
Sand	68.03	,,
Organic debris	0.14	,,
Moisture	2.59	,,
Fine Earth (20 mesh sieve)	85.355	,,
Insoluble in nitric acid	73.100	,,
Potash (K_2O)	3.411	,,
Magnesia (MgO)	0.641	,,

Lime (CaO)	0.378	per cent.
Alumina (Al_2O_3)	2.780	,,
Silica (SiO_2) soluble	0.641	,,
Phosphorus (P_2O_5)	0.004	,,
Ferric oxide (Fe_2O_3)	2.235	,,
Moisture and organic matter	2.140	,,

Remarks:—1. The soil contains traces of humus, sodium. sulphur, and manganese.

2. The earth is from an area inhabited by animals which visit Salt-Lick No. 20.

XXXI.—SOIL FROM SALT-LICK.

SERIAL NO. 27.

LOCALITY—Level country some 30 miles from the foot of the Himalayas, near Murtiha in the Reserved Forest of Bahraich District, United Provinces.

COLLECTED AND SENT BY—The Divisional Forest Officer, Bahraich.

Buff coloured hard clayish lumps. Powder soft.

Minerals	0.54	per cent.
Clay	20.49	,,
Sand	73.08	,,
Organic debris	1.90	,,
Moisture	2.83	,,
Fine Earth (20 mesh sieve)	96.627	,,
Insoluble in nitric acid	80.430	,,
Soda (Na_2O)	0.081	,,
Potash (K_2O)	4.005	,,
Magnesia (MgO)	0.862	,,
Lime (CaO)	0.443	,,
Alumina (Al_2O_3)	3.730	,,
Silica (SiO_2) soluble	1.307	,,
Sulphur (SO_3)	0.171	,,
Phosphorus (P_2O_5)	0.129	,,
Manganese (Mn)	0.009	,,
Ferric oxide (Fe_2O_3)	3.125	,,
Moisture and organic matter	2.336	,,

Remarks:—1. The soil contains traces of chlorine.

2. The lick has been frequented for many years by wild animals, especially chital.

REVIEW.

MIMICRY by G. D. Hale Carpenter, M.B.E., D.M. and E. B. Ford, M.A., B.Sc., pp. i-viii and 134 (illustrated), Methuen & Co., Ltd., London.

Evolution and Natural Selection like most other scientific subjects has grown into so vast a study that specialization has been more or less forced on the student. One of these special branches is that of Mimicry and in the short monograph under review, Dr. Hale Carpenter and Mr. E. B. Ford have dealt with the enthralling subject not only as those who have studied under the learned Professor to whom they have dedicated the work, but also, in the case of the former, from the standpoint of the field-naturalist. In this book Dr. Hale Carpenter gives us actual facts observed by himself in British East Africa, facts which will be hard to refute even by the most bigoted opponent of the theory of Mimicry.

The work is divided into three parts together with a short introduction which the student will be well advised to master before he proceeds to Part I, as in it will be found the explanation of terms employed throughout the book.

Part I gives a short account of the original work by Bates, Wallace, Trimen and Fritz Müller, whilst Part II is an essay on the more modern work on the subject. The two parts are co-ordinated by a system of reference numbers, the paragraphs in Part II being numbered to correspond with similarly numbered points in Part I which they serve to amplify; the student may thus refer forwards or backwards as he proceeds with his studies.

Part III which has been written solely by Mr. E. B. Ford, deals with the genetics of Mimicry and will be found of more interest to the biologist.

Examples of Mimicry were first discovered among the *Lepidoptera* so that, as one would expect, this Order holds a prominent place in the work under review. This, from the Indian student's point of view, is rather unfortunate as the Indian *Lepidoptera* are by no means rich in mimics although we do possess some outstanding examples. Of these we may mention *Hypolimnas misippus*, the female of which mimics *Danais chrysippus;* the Papilios of the Agestor and Clytia groups which copy *Danais* and *Euploe* respectively, and the two species of *Kallima* which mimic a fallen dead leaf so marvellously, and which, to heighten the resemblance, turn flat on their side as they alight on the ground! Another striking example which has imposed itself on collectors is that of *Sataspes infernalis*, a daylight flying Sphingid which copies bees of the genus *Xylocopa*.

Examples have however not been confined to this order and several others are exemplified such as the *Coleoptera* and *Hymenoptera* which are as rich in mimics in this country as in Africa. The two plates refer to these and it would have much enhanced the work if there could have been more of such.

Much original work still remains to be done by the student interested in this branch of biology and for him no better work could be recommended to introduce what is not only an interesting study but a fascinating hobby.

The value of the book would be considerably enhanced if in future editions a short appendix was added giving examples of Mimicry found in various countries. Students in this country have no access to examples of African *Lepidoptera* or other Orders from that continent and this is a study which above all needs living examples to point the moral.

F. C. F.

MISCELLANEOUS NOTES.

I.—A TIGER ATTACKING AN ELEPHANT.

As promised, I am sending you particulars of an attack on a mature cow elephant by a tiger.

The incident came to my notice on the 15th May this year, when Mr. F. J. Davy who is an Elephant Hunter and Control Officer in the Plus Valley, Perak, F.M.S., invited me to accompany him on his inspection of the patrolled 'rentice' or track beyond which it is the duty of the patrols to drive all wild elephants. This track, which is 13½ miles long, lies on an average 5 miles from the cultivated land which it protects. It is inspected daily by Sakai and Malay patrols, and if wild elephants cross they are followed, turned and driven back. Only in extreme cases, when they refuse to be driven and show signs of truculence, is shooting resorted to.

This is 'by the way' and merely explains the object of my trip.

The jungle track follows the bank of the Kerbau river, a considerable tributary of the Plus River, the latter being the main tributary of the Perak River. We enter the jungle at the village of Jalong which it is now possible to reach by car. On arrival at Jalong, we found an elephant waiting to take our bedding and kit. Mr. Davy drew my attention to a scar about two feet long stretching from behind the elephant's right foreleg and finishing up under her belly. He told me this happened about six months previously. Savage, the Government Geologist, had hired the elephant and stopped the night in the jungle, as we were doing, near the junction of the Plus and Kerbau rivers. The elephant was let loose as usual to feed at night with a 'singkah' (rattan shackle) on to prevent her straying too far.

In the morning she appeared at the camp with a huge wound and a piece of flesh and skin hanging almost to the ground. Investigations showed tiger tracks where she had been lying and it was evident from an inspection of these tracks that the tiger had attacked her as she lay, probably clinging on with teeth and claws and tearing the flesh by its weight as the elephant got up.

The victim would not allow anyone to touch the wound, and a suggestion by the Health Officer to cut away the hanging flesh could not be carried out. She could not of course be worked after this and was left to her own devices; her recovery being due entirely to her own efforts.

On every possible occasion she bathed the wound with mud from certain wallows which she selected, possibly for their healing qualities, and when not doing this she continuously fanned the wound with a light switch of 'lalang' grass held in her trunk. In this way she kept flies and other insects from the wound.

The torn flesh gradually shrivelled up and fell away and at the end of three months she was fit for work again, a slight scar being the only evidence of what was no doubt intended for a murderous attack on her vital organs.

Her temper remains as placid as ever and she shows no signs of nervousness when released near the scene of the attack or when a tiger is known to be about.

To the best of my knowledge the above incident is without parallel in Malaya and I have not heard of a similar case in Sumatra. It is possible that you may have recorded a like case in India. Elephant calves have, I know, been attacked but I have never read of an entirely unprovoked attack on a mature elephant.

If you think the above will interest your members you may publish all of it or such parts as you think fit.

SPORTS CLUB,
ST. JAMES'S SQUARE, I. K. SWAINE.
LONDON, S.W. 1.
June 21, 1933.

[There are a few instances on record of Tigers attacking elephants. Sanderson shot a tiger in Chittagong which had killed a young elephant about 4½ ft. at the shoulder and weighing perhaps 600 lbs. He also heard of a tiger in Assam severely mauling an elephant which had been hobbled and turned out to graze. A note in the *Journal* (vol. vii, p. 119, 1892) by Q. G. Corbett, Deputy Conservator of Forests, gives a few instances. A female elephant and calf turned loose to graze were attacked and mauled by a tiger. This occurred in the Pegu Yomas. The tiger went for the calf and mauled the mother when she tried to rescue it. The calf was killed and found partly eaten the next day.

In the same area a full grown female elephant was severely clawed and bitten on the shoulders and back by a tiger. The animal sprang on her when she was asleep. Four days later a big tusker was attacked, in a narrow nullah. The tiger leaped on him from the bank, was shaken off more than once but attacked again and again. The elephant got off with dreadful wounds along the whole length of its back. It is presumed that the same tiger was responsible for the three separate instances recorded by the writer; his initial success with the calf and mother emboldening him in the pursuit of quarry which tigers usually recognise as beyond their powers.—EDS.].

II.—A SPIRITED OLD BULL BISON (*BIBOS GAURUS*).

It is not often that a Gaur charges at the first shot, but this was our experience recently when I was out with that fine sportsman, Mr. Herman Cron.

The bull, a solitary, was standing in thick cover on the edge of a narrow strip of evergreen jungle. He was turned out by our trackers, sent round for this purpose, while we waited for him to cross our front. We were standing well downhill on an open grass hillside. The bull literally bounced out after demonstrating at our trackers and, spotting us, as Mr. Herman Cron raised his rifle, wheeled and faced us. On receiving Mr. Cron's first shot the bull immediately put its head down and charged from a distance of about 12 yards, but was turned by a second shot and bagged a few minutes later.

This bull had been mauled by a tiger previously, and this may have accounted for his irritability although the scars were old. Curiously enough this was the third solitary bull found to have been previously mauled by a tiger and shot in succession in the same area.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE, S. INDIA.
March 30, 1933.

R. C. MORRIS, F.Z.S.

III.—THE COLOUR OF 'WHITE BISON' (*BIBOS GAURUS*).

I was much interested in Mr. Morris' account of the 'White Bison': the colour of which he describes as being 'sandy or light fawn'. In *Wild Animals of Central India* I referred to the fact that Bison are 'very occasionally *dormouse-coloured*'.

This description is synonymous with Mr. Morris', and there is no doubt that we are both describing the same variety of Bison. The term 'white' is a misnomer and should be discarded. As my publication of the fact that this variety of Bison occurs gave rise to no comments I assumed it was a well known fact to those, who were really familiar with Bison. Mr. Morris' letter however makes me suspect that it is not so well known; and it would be interesting to know whether this variety of Bison occurs in numbers.

IVYBANK,
BISHOPMILL,
ELGIN, N.B.
June 5, 1933.

A. A. DUNBAR BRANDER.

In regard to Mr. A. A. Dunbar Brander's note on 'White Bison' I am fully aware that in *Wild Animals in Central India* the author refers to the fact that Bison are occasionally 'dormouse-coloured'.

This, however, can in no way be said to describe the colour of the 'white' Bison. In my note on 'White Bison' (*J.B.N.H.S.*, vol. xxxvi, p. 492) I mentioned that a large number of the Bison in the 'white Bison' area are of a somewhat lighter colour than is usually the case in other districts of South India, i.e. the Western Ghats, the Nilgiris and Wynaad, and the Billigirirangans, and *these* light coloured Bison can certainly be described as 'dormouse-coloured', and are evidently the variety referred to by the author of *Wild Animals in Central India*.

The 'white' Bison however are far lighter than this, being of a very light sandy or fawn shade, and Mr. Dunbar Brander's description is not applicable in their case as he would himself admit were he to see them. I consider that the term 'white' should be retained, as although this does not closely describe their colour it serves the purpose of distinguishing the variety.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE, S. INDIA.
June 21, 1933.

R. C. MORRIS,
F.Z.S.

[Mr. Dunbar Brander has sent in the following letter from Mr. R. L. Scott:—"Certainly the light coloured bull Bison which I saw in the Banjar Valley, in company with another good bull of normal colour, could in no sense be described as 'White'. My recollection is that the whole body was about the same colour as the top part of the head of the old normal bull which I have mounted, which you may remember was a very old one. This head has been hanging for some years in the light, but I do not think the colour has changed. I should say that 'dormouse' describes it very fairly—certainly not 'white'."

Concluding Mr. Dunbar Brander writes:—"As I have not seen the bison, Morris refers to, and he has not seen the areas I refer to, precise determination of the matter is difficult.

However, the following point emerges; having kept dormice as pets and having asked others who have kept them: we are unanimously agreed that the colour of a dormouse is 'a very light sandy or fawn shade': so Mr. Morris and I are describing the same colour in different terms.

The colour is found on the flanks of a cheetal before the brown merges into the white.

In my opinion Science and Natural History cannot possibly benefit by the adoption of an inaccurate term: the term 'White' is no doubt more sensational but the animals should be called 'Sand or dormouse coloured Bison'.

In the Central Provinces some jungles tend to produce a darker or lighter type of normal bison as the case may be: but these dormouse coloured animals do not appertain to any particular tract and may be found associated with animals of the darkest colour. I am certain that the animals to which I refer in *Wild Animals in Central India* are essentially the same as those to which Mr. Morris now refers."—EDS.].

IV.—CURIOUS DEATH OF CHEETAL (*AXIS AXIS*) IN CAPTIVITY.

There were kept in an enclosed run in the Palace here 8 spotted deer—2 stags and 6 hinds of different ages. This morning, news was brought that 7 of the animals including a stag were found dead; while one of the stags had jumped out and was roaming about in the garden. I found that all the dead animals had thrust wounds, invariably in the hind quarters, on or below the hind legs. One had a wound behind the front shoulder blade. A hind was found in a trench outside the enclosure with a small portion of the hind quarters, including the tail eaten away by some animal. The flesh eaten away was not much—possibly the work of a jackal or a dog. The surviving stag was seen in the garden, quietly resting in a shed and chewing the cud. We did not go near him for fear of disturbing him and making him jump over the garden walls. He did not seem to have received any wound nor was he in any way affected by the occurrence. I am not able to explain how so many animals were gored to death; 6 of them being hinds. During the rutting season, I have seen stags fighting and killing each other, but I have never known of a stag running amok in this way. All the books consulted do not throw any light. A keeper in the local zoo told me that in the zoo there is a fierce stag which fights and gores other animals, including hinds. They have now separated him and given him a solitary cell. Till yesterday evening, the watchers tell me, there was no indication of any rutting trouble and the animals were all quiet. What can be the explanation of so many deaths? From the bruises received on the nose and lips, it is plain that all the animals made frantic attempts to squeeze themselves between the bars while they were being gored. Would an angry stag gore and kill wholesale so many hinds both mature and immature? Or can it be that a jackal or a wild cat entered the cage and the deer taking fright stampeded, and in the attempt to escape, received thrust wounds from the antlers of the stag? But the carcases were all lying scattered in different places inside the cage and not huddled up in one corner. If the culprit was the stag found outside, how and why did he jump out of the enclosure? I may say that the antlers of the two stags are neither well-formed nor big but really misshapen and very poor. A broken tip of the antler of the escaped animal, about 4 inches long, was found inside the pen.

I shall feel thankful if you will kindly throw light on this incident.

TRIVANDRUM. DANUSHKOTI PILLAI,

June 21, 1933. *Conservator of Forests.*

[Dr. Laud, Superintendent of the Victoria Gardens, Bombay, offers the following explanation for the occurrence:—

"I have read the letter from the Conservator of Forests, Trivandrum, giving an account of casualties among so many spotted deer. From my experience, I do not think that the deaths were caused by the stag going wild and running amok, especially in face of the fact that his horns were poor and not well formed. During the rutting season, the males fight with one another and one may cause the death of the opponent by goring and possibly may injure a hind or two but there would not be such a wholesale slaughter. I have reason to believe, from my experience of such happenings in our Garden also, that a stray dog or jackal or some wild animal may have entered the enclosure, and caused a panic. The deer made frantic attempts to escape from the barred enclosure with the result that there were so many wounds and deaths. This is the only explanation I can offer. We have had stray dogs entering our enclosure, causing deaths amongst deer and even kangaroos in like manner; the animals either being injured by the dogs or killing themselves in trying to escape.''—Eds.].

V.—'FUR FARMING'.

Furs are probably the oldest form of clothing in the world and we can well imagine that our ancestors who were still living in caves, first of all saw them purely as a wrapping to keep out the cold and later allowed them to become a sign of wealth and well-being. In those days, the best hunter was probably the wealthiest man, and it was just the best hunter who was able to secure for himself the choicest and most beautiful pelts. For a great many years our old friend the rabbit has been bred, partly at any rate for his skin, and today in, say, the 'Show Angora' or 'Chinchilla', one can hardly recognise the humble rabbit of the warren. The 'Fitch', which is really only a specialised Pole Cat, a form of ferret, has also been bred in Europe for probably some two or three hundred years. The breeding of animals for their fur was what may be called a cottage industry. Recently, fur farming, that is the farming of animals with their pelts as the main object, has come more and more to the fore.

I think the animal originally farmed on a big scale in this way was the Silver Fox and the causes which led to his being bred in captivity were different from those in the case of other animals. The Silver Fox, or more correctly, the Silver Black Fox is a melanistic sport of the American Red Fox '*Vulpes fulva*'. It occurs very rarely in the litters of red parents, and it has recently been proved that the silver-blackness is an ordinary recessive Mendelian characteristic, that is, the offspring of a red and a black fox will be all red and the f2 generation will be in the proportion of 3 reds and one black. Two blacks, will of course, produce nothing but black offspring; but this is only partially true, as the blackness is developed to a variable extent and you actually get both wild and in captivity, all stages from the red to the pure black. The fox in which the black parts are pure black is technically 'A Silver Fox' the other stages are known as cross or patch foxes. I believe efforts were made as far back as 1860 to breed black cubs in captivity. The Silver Fox skin in those days was a very great rarity and the big prices fetched gave promise of unheard of returns to the man who could manage to keep up a permanent supply. It was somewhere about 1890 that a Red Indian is said to have come into a Hudson Bay post with three wriggling black cubs in a bag which were bought and reared. They did not breed for a year or two but in 1894 a litter of cubs was successfully raised. From these animals one line of Silver Foxes was started. At first casualties were frightfully heavy but with growing experience the stock increased. About the same time, alhough neither knew of the other, another pioneer was developing a similar strain in Alaska. Eventually the two strains were united in Prince Edward Island. The credit of establishing the strains from which the modern Silver Fox is descended belongs to Charles Dalton and Robert Oulon. As much as 1,800 dollars was paid in 1900 for a skin and from time to time a few others came on to the London market. Eventually friends were let into the business and a big boom set in. Just before the War the average pair of live foxes was fetching as much as 16,000 dollars and a special pair is said to have been sold alive, for breeding for 25,000 dollars (£5,000). The War caused a considerable setback and by the time it was over, the available stock was considerable and prices were more reasonable. In 1920 the first farm in Great Britain was started near Alness, in Ross-shire, and since then the industry in this country has increased enormously. The Silver Fox Breeders' Association now has about 200 members; many of these keep their foxes on farms owned by others, of which there are about 70 in the country. But the British contribution is still only a drop in the world supply of pelts.

In the case of the Silver Fox, the reason which led to their being bred in captivity was their extreme rarity. In the case of all other animals—Nutria from South America, Mink, Silver Badger, Blue Foxes, Cross Foxes, Raccoons, Fisher, Musquash, Marten, etc.—the reason is different. Fur bearing animals all like solitude and quiet. Every time a clearing is made or a new farm or mine is established, we cut into the area available for them. A man making a clearing in a forest not only frightens the animals from his actual clearing but from the country around it, and so the whole tendency of civilisation is to restrict the areas available for fur bearing animals, and therefore the supply of furs. Until quite recently, the loss of suitable country in one direction could be made up by the extension of trapping operations into still more remote and inaccessible places, but there is a limit to this. In North America, Arctic conditions prevail in the extreme north, and this point has now been reached.

I believe that recently somebody perfected a species of wheat which takes 10 days shorter to ripen than normal wheat. In Canada, the Wheat Belt is limited by the time available between the thawing of the snow at the end of one winter and the start of the next; therefore the shortening of the time required for ripening, allows the Wheat Belt to spread to the North, into country where this period is shorter. This is an example of what cuts into the country left available for trapping. The northern limit has been reached, therefore the area becomes smaller; therefore, in turn, trapping becomes more intensive and finally, even with the most careful protection, certain fur bearing animals become so rare that it no longer pays to try and trap them. This stage has not yet been reached, but it is disinctly in sight, and the result is that attempts have been made to breed almost every fur bearing animal in captivity. In the case of a Silver Fox, the scarcity and value of his pelt was the factor which led to his partial domestication. In the case of other fur bearers, it is the fact that we are now within measurable distance of their becoming almost as scarce as the Silver Fox once was, which has led to their being bred in captivity.

Breeding each species has its own technique, as is natural, but the same general rules apply. Cleanliness and sanitation, security against escape, combined with sufficient room for exercise. In the case of Silver Foxes, which is what I know most about myself, almost as many types of pen have been developed as there are farms. I favour one of the simplest—it is a wire netting pen 30 feet by 10 feet by 6 feet high. 20 feet of this can be shut off by a door, and has a floor of 1 inch boards. These are much easier to keep clean than earth, and I find that it decreases the incidence of worms. The end 10 feet has an earth floor with a wire net mat a foot under the ground which gives the foxes a chance of digging, and I keep the puppies out of it until they are about 2 months old. Other types may be up to 1,000 square feet in area or even more; 40 by 40 feet or 50 by 25 feet; for these a board floor, is of course, out of the question. The wire netting of the sides is dug into the ground for about 2 to 3 feet at the foot, and in place of a roof, we have a 2-foot overhang the whole way round. Combined with pens one often finds large enclosures of half an acre to an acre in which the foxes are turned out for exercise. I myself, managed to keep 6 adults in such a pen last year, but this year when I tried 20, there was a good deal of scrapping and fighting and finally one afternoon my headman came down to me with a very nice brush in his hand and said 'this is all I can find of one of your vixens; I do not think she can be very well!' Except for 3 feet and about six square inches of fur, this is about all we ever found of her, and large pens for adults have since been at a discount, but for cubs until they are say about 8 months old, they are splendid. One certainly loses an occasional beast, but one loses that in any case and if they were confined in small pens, the losses due to the confinement, would probably equal the losses due to the big pens, while the animals would not be nearly so fit at the end of the season.

Prices for good stock at present run from about £100 to £125 per pair, and it is to be emphasised that it is no good attempting to do anything with bad stock. The food bill for an adult pair and say 3 cubs runs into £15 to £18 a year, which is absolute out of pocket expenditure and unless you can realise the amount from the sale of your increase, the result of your year's working is actually a loss instead of a gain. With good stock it is not difficult to do this, but it is a very difficult matter with poor stuff; and I, personally, would not accept for stuff, even as a gift. The usual method for a beginner to start in the business is to go to an established farm, buy stock from it and ranch that stock with the farmer for a year, while learning the job himself. Tuition is free to purchasers of stock and the time taken for a man of ordinary commonsense is two to three months, combined with one or two visits to learn essential jobs such as tattooing and pelting at the proper time of year.

This is not the time or place to enter into a dissertation upon all the details of the routine of a fox farm, and I am only giving a few points of general interest. The food consists of meat,—beef, venison, mutton, rabbits, hares, tripes and occasional horse (although I do not like it very much), usually fed raw; porridge containing various cereals, milk, eggs, soup, biscuits and fox meal, which is very similar to hound meal and, in fact, almost anything which you would feed to a valuable dog, except that the proportion of meat is considerably higher. The menu for a sample week here is made up approximately as follows:—

2 tripes, 24 hares, 100 lbs. venison, 100 lbs. beef, 25 couple rabbits, 100 eggs, 7 gallons milk, 4 lbs. salts, 5 gallons soup, 100 lbs. porridge, 10 lbs. biscuits, 10 lbs. fox meal, 5 lbs. bone flour, 10 lbs. vegetables, 64 lbs. brown bread, 2 pints cod liver oil.

The puppies are inspected by an inspector appointed by the Silver Fox Breeders' Association of Great Britain and Ireland who passes them if they reach a certain standard, and they are each tatooed in the ears with identification letters and numbers—Each breeder has his letters,—mine are DM—and each year has a letter. The cubs belonging to each breeder are serially numbered; thus a fox—DM J21 is cub No. 21 born in 1932 on the Sidlaw Fur Farm, and he can never be mixed up with any other animal. Certificates of registration are issued and all changes of ownership have to be registered on the Certificates. Any application for transfer must be signed by the owner of the fox, so there is not very much chance of losing your animal.

While Silver Fox Farming cannot in any way be compared for security to say, War Loan or even a good Debenture, it can be made as safe as any form of live stock breeding, and the interest which it pays on the capital laid out is, luckily, also not comparable to that paid by War Loan. I reckon at the present time it is 15 to 20 per cent and that the business is as safe as anything paying returns of this nature.

There is a method by which a man with about £1,200 to £1,500 capital can work up to a stock of 40 pairs in six years, financing each year's expansion out of profits. It takes about 5 or 6 years, and means hard work for that time, but should yield an income of about £800 to £1,000 a year on Pelt sales, once the farm has finished growing. But the owner must have a small income to keep himself up till then. It was worked out for a man with a small pension and a gratuity and provident fund for capital.

There has been a good deal of discussion lately about the respective merits of the small and the large farm. To begin with, I think everyone agrees that the excessively small farm—of 10 or 12 pairs is not an economic proposition. It is all right as a side line to some other business or a hobby, but the overheads are too high, and the profit is too small to yield a living. It is the same with everything—the village post office is only possible when run in conjunction with a small shop.

For breeding stock, the small farm, say 20-24 pairs, is undoubtedly the best. This is borne out by Show results; at last year's London Show, 5 out of 6 major awards, 6 out of 7 colour championships, 20 out of 27 first and 23 out of 24 seconds were won by small farms; a small farm headed the list of prize winners by a considerable margin, and there were only two big farms in the first 9. It cuts no ice to say that there are better beasts left behind than those brought up to the Show. Everyone naturally tries to bring up their best, and as shows and wins at shows are the best and cheapest form of publicity, very much attention need not be given to those who are too proud to show.

The success achieved by the small farms is due to a variety of causes, chief among which are the careful personal attention which can be given and the lack of room in which to house anything but the best, which leads to continuous improvement. Where there is no room for poor animals, there can be none of their progeny for sale.

The large farm certainly offers certain advantages, and is best for the man who does not want the trouble of looking after his own stock; but in such a case, he has to pay for his facilities either directly or indirectly, and he cannot expect such high returns as the man who runs his own business himself, while the continued existence of the concern as a whole often depends entirely on one man, and has all the risks attendant on such conditions. For the man who is willing to work himself and who wants to get as high a return for his capital and time as he can, there is no doubt that it is best not to be tied down to the level inseparable from any large stock-raising concern, but to own his own farm, and to start from a farm with similar ideals.

It is a most intensely interesting business for a man used to the open air, and fond of animals; but he must have certain fairly obvious qualifications—the power of observation for one. I've heard of a man who thought a fox had been asleep for a whole day—until he found it had been dead. The city clerk who has never even kept a dog has about as much chance, without special training, as one of us would have if we tried to understand his accounts. Another source of failure is shortage of capital. One must be able to build pens, buy stock, and keep it while it is increasing, and feed and keep oneself while the process is going on. I reckon that the minimum on which one can set up for oneself and start earning an income, is about £2,000, though this may be reduced by various circumstances. Given the necessary capital, and aptitude, I can imagine no business more congenial.

J. M. D. MACKENZIE,

PERTHSHIRE,
SCOTLAND.
May 22, 1933.

VI.—NOTES ON THE HABITS OF RADCLIFFE'S SIBIA (*LEIOPTILA MELANOLEUCA RADCLIFFEI* STUART BAKER).

(*With a photo*).

The Sibias with their lovely plumage, and with their sweet, clear, and plaintive call notes are among the most fascinating of the hill birds.

Radcliffe's Sibia which I have found common in some parts of the Southern Shan States seems to have escaped the notice of observers, in spite of its tameness and persistent call.

There have been but four skins hitherto in collections—or that is, what is on record—and these have not received the careful attention they deserved. So it is that the description of this bird in the *Fauna* is meagre and inaccurate.

It is known to the Toungyos as '*Nget kya*', or the pied bird, and they certainly know a great deal about it. All the information they gave me concerning this bird turned out to be correct. When they brought me blue eggs capped and marked with rusty red and told me they were the eggs of this bird, I was more than doubtful, as the eggs which I had already obtained myself were pale blue and immaculate. They were however quite right as I subsequently found out for myself.

Nest and eggs of Radcliffe's Sibia (*L. m. radcliffei*).

Radcliffe's Sibia in the field appears to be a sleek black and white bird, with lovely clean cut lines. Rather shrike-like and extremely tame. They are very affectionate birds and always in pairs—though several pairs will go about together, even in the breeding season. I very reluctantly had to shoot a few specimens to authenticate the eggs I took, and for scientific purposes. In doing so the distress shown by the mate of the bird I had killed induced me to shoot it also. I need hardly say I shot the minimum required—I think it was five in all. Now the skins have been sent to the British Museum we may hope for an accurate description of them in subsequent works.

As I have no skin before me now I am unable to give here such a description, but I can say in relation to the description in the *Fauna* that the deep, glossy black of the upper parts passes imperceptibly into a warm, deep chocolate brown on the back and mantle. It is a peculiar colour that I have not noticed in any other bird. It has a small spot of black on the chin at the base of the lower mandible. The bases of the primaries—and to a less marked degree of the secondaries—are white (except the first small primary which is wholely black) and this gives the bird a white wing patch in flight. This is an important recognition patch. I did not notice any variation in these birds—either in the skins, or in the field.

NIDIFICATION.

As nothing is apparently on record, I will endeavour to fill in the gap. I first found the nest in 1929, in May. It contained two pale blue eggs of very delicate colour and texture. The shells were fragile. The nest was shrike-like and about 12 feet up in a tree.

This year, I continued my observations and on March 20 found the first nest in a very similar place. I shot the parent bird, and took photographs of the nest and eggs. The eggs were two in number, and, as before, immaculate pale blue. They measure approximately 23 by 16.5 mm. They are of delicate shape and Eton blue. Like most blue eggs they fade rapidly.

Subsequent nests and eggs found were at first of this type, the nests being lined with a coiled, black hair-like substance[1] which comes off some tree. It is used by the Toungyos (who get it from the Sibia's nests) as a remedy for headache! They make an infusion of it in hot water etc.

Some nests were well concealed in the outer branches of heavily foliaged trees, and were only discovered by watching the parent birds. None were lower than about 7 feet, and some were as high as 30 feet.

About this time, say the middle of May, I was brought some eggs by the Toungyos which they said were Sibia's. These eggs were the same size but very different in appearance being rather greener and well marked with red. There was, as far as I knew, only this one species of Sibia in the neighbourhood. I put the eggs aside, and continued my search, and very soon found several clutches of marked eggs, shooting the parent birds in two instances to make absolutely certain.

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[1] Samples of this hair-like substance submitted to us proved to be the stalks of a species of fungus which grows on fallen decomposing leaves.

The full clutch of Radcliffe's Sibia appears to be one egg, or two—and rarely three. I found several sitting on one egg.

I found fifty eggs before finding a clutch of three eggs. Curiously enough in this clutch was a giant egg twice the size of an ordinary egg, but in every other respect exactly like the other two of the clutch.

It was only after finding about 30-40 clutches that I came across eggs intermediate in character, i.e., sparsely marked. Then I got a few—some showing a few scroll lines approximating to Barwing's eggs.

It then appears that this bird lays eggs of two distinct types—immaculate and marked. The marked eggs are generally capped—rarely zoned with rusty red. The variation in size is rather wide.

Suspecting the proportion of marked to unmarked eggs to be almost equal, I reviewed the first 40 eggs and found that I had exactly 20 marked eggs and 20 unmarked! Up to that time I had seen no clutch of 3 yet nor had I seen any eggs of an intermediate type.

The breeding season I found to be from the end of March to early June. No cuckoos' eggs were found in this Sibia's nests.

HABITS.

I have alluded already to their affectionate nature and their being always in pairs. They were already calling when I came up into their district in January.

They play follow-my-leader from tree to tree like the Blue Magpies do, and like those birds, they usually settle low in a tree and climb up towards the top with quick, long hops from branch to branch. They feed a good deal on the wild yellow raspberries that there abound.

The call is one of the most beautiful sounds to greet you as you get up beyond the 4,000 foot level. It is a sweet, thrilling cadence of double notes—falling, and the last prolonged plaintively. The alarm note, a rather shrike-like abuse.

They call before dawn, and all through the day, but very little after about 3 p.m. It is a real bird of the morning in its happiness.

The flight is rather weak, and direct; only undertaken to get from one place to another. I did not notice any birds actually on the ground, but they are often within a foot or so of the ground when searching for fruit.

I hope to hear the Sibias calling again next year—and I shall then come as a friend and not to kill or despoil them.

YAUNGWHE,
S.S.S., BURMA.
June 18, 1933,

T. R. LIVESEY.

VII.—A NOTE ON THE MIGRATION OF THE SWALLOW SHRIKE (*ARTAMUS FUSCUS* VIEILL.)

Though Jerdon includes the Northern Circars in the list of areas where he found this species most abundant, yet it is not reported by the Vernay Scientific Survey of the Eastern Ghats. And the most probable reason is, think Whistler and Kinnear (see vol. xxxvi, p. 347 of this *Journal*), that the bird is a migrant in this area. As there is no further record until Madras is reached, my notes on its occurrence in Elwinpet, Cocanada, may be of interest.

From pretty close observation, ranging over a long period, I think this bird comes to Cocanada during the hot weather for breeding purposes. It makes its presence known by its constant harsh screeches, made when driving away every other bird from the vicinity of the tree—usually a Palmyra palm, which it selects for its home. Drongos, crows, hawks and even kites flee before its lightning swoop. It is not an uncommon sight to see a dozen of more of these birds huddled together in the fronds of the Palmyra.

The birds appear in large numbers about the beginning of April and building operations begin almost immediately. Some nests are completed by the end of April; while other birds are seen still tugging at coir or jute or carrying straws, even during the middle of June.

Immediately after June, the noise and din made by these birds ceases and they are not seen again until the month of September. They disappear again about the end of September and reappear towards the end of December or beginning of January and are not seen again till the beginning of April.

During these 'non-active' months, one may occasionally see a bird or two flying very high up as if bound on some distant journey, uttering its shrill call. They never appear to come down. The truth seems to be, that, like the koels, these birds spend part of the year in the interior and appear along the coast only during the summer months—April to June. They appear to shun civilization and are found only in open and uncultivated tracts. They come with the beginning of the hot weather and disappear before the monsoon sets in, about the middle of June.

Elwinpet, Cocanada,
Godavary.
June 10, 1933.

A. S. THYAGARAJU,
M.A.

VIII.—SPEED OF THE LARGE-PIED WAGTAIL (*MOTACILLA MADERASPATENSIS* GMELIN).

While motorcycling sometime back, I had two occasions to test the flying powers of the Large-Pied Wagtail (*Motacilla maderaspatensis*).

On a fine stretch of road between Dakor and Mahudha (Kaira District), I started some Large Pied Wagtails feeding in the middle of the road. Others flew away, but a couple of the birds went ahead, straight in front of my bicycle. In order to find something about their power of flight, I slowed down to a mere twenty miles an hour. At this speed, it appeared that the birds were drawing away from me, so I accelerated to twenty-five. Then the distance between the birds and myself began to remain constant. The moment I went to 27 miles per hour, the cycle drew nearer the birds. This went on for about a couple of hundred yards. Then came a sudden turn in the road, the birds kept on flying straight, while I had to swerve to the right thus getting no further chance to continue the observation.

Next day, when cycling from Nariad to Kaira, I had another opportunity to repeat the experiment. This time there was only one bird which maintained its distance at 25 miles per hour. It was flying at about four yards from the front wheel, level with my head and went on for about 300 yards. Then it swerved and flew away.

On both these occasions, the birds on wing did not show any fright, in spite of the great din created by the open exhaust and also by the single cylinder bike of my friend who was driving abreast of me; my mount being a 'twin Indian' which is a silent machine. The trip was from Ahmedabad to Baroda and back.

AHMEDABAD, HARI NARAYAN ACHARYA,
N. GUJARAT. F.Z.S.
March 29, 1933.

IX.—CUCKOOS IN THE SOUTHERN SHAN STATES.

(*With a plate*).

To those interested in the parasitic cuckoos, the following summary of 47 days spent this year in search of their eggs in the Southern Shan States is recorded.

The locality searched was in the neighbourhood of Taunggyi, and on the same range of hills at an elevation of 4,000-6,000 ft.

The first cuckoo's egg (*Cuculus canorus bakeri*) found was on April 6 and it was on the point of hatching. So it would appear that this cuckoo begins to lay in the latter half of March.

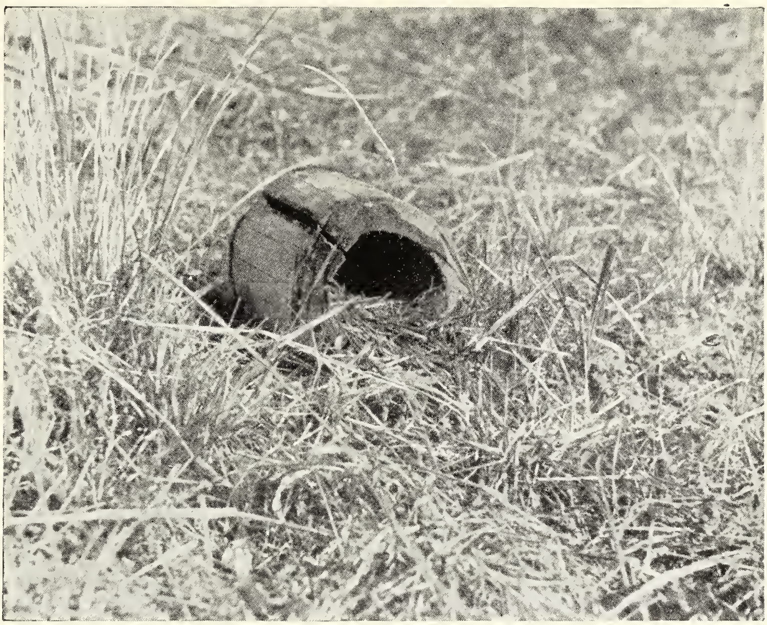
The first cuckoo was heard calling on March 9, about a week earlier than is usual in the Shan States.

The locality was left on May 22 when the rains had set in. As many fresh eggs were then being found—and among them eggs of certain birds not previously obtained—it is probable that they go on laying throughout June.

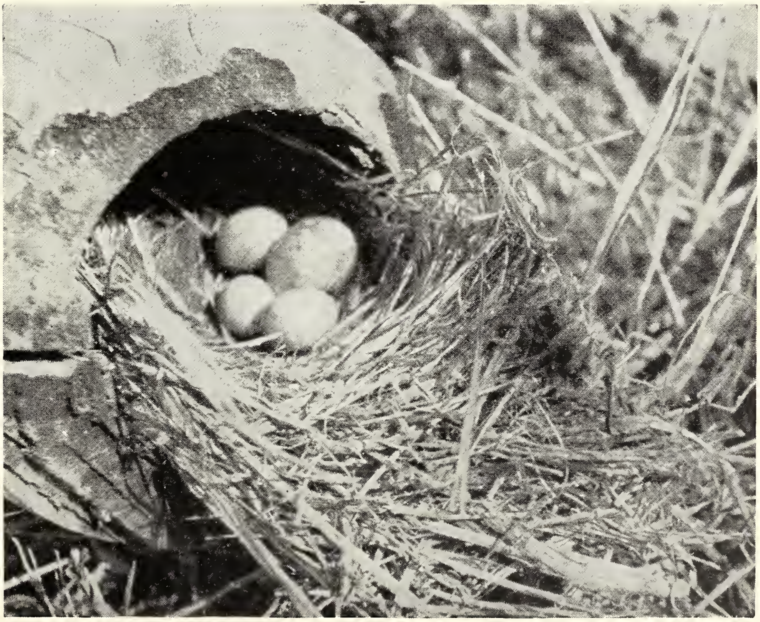
The total number of cuckoo's eggs found in the period of 47 days was 103.

Of these, 90 were eggs of *C. c. bakeri*. The remaining 13 eggs seem to belong to four different species of cuckoo, and of them, mention is made at the end of this note.

The eggs of *C. c. bakeri* being as many as ninety in so short a period, and in one small area may be considered in more detail as giving a general idea of this cuckoo's habits in the Shan States.



Nest of the Burmese Stone Chat (*Saxicola c. burmanica*) in a section of hollow bamboo lying on the ground. 22-4-33.



As above. Nest drawn out to photograph eggs. 3 eggs of the Burmese Stone Chat and one of the Khasi Hills Cuckoo (*Cuculus canorus bakeri*).

Photos by the author.

THE EGGS.

The eggs of *C. c. bakeri* in this area are not unlike those found in Kashmir in the nests of *Emberiza cia stracheyi*, but the resemblance to the eggs of the fosterer here in the Shan States (*Saxicola caprata burmanica*) is more marked. They are of two distinct types:—

1. The commoner has the ground colour pinkish, or yellowish white—freely marked with flecks and spots of dull light red—mostly at the larger end, and tending to form a zone.

The markings are not, however, very distinct, and the general appearance of most eggs is of soft and suffused colour.

No eggs of this type were found showing any tinge of greenish, or blue, in the ground colour.

Of 90 eggs all but 14 were of this type—including 4 eggs which were so pale as to be almost uniform white.

2. Immaculate, pale blue eggs.

Out of the 90, 14 were like this, one only showed traces of marking.

The eggs varied greatly in size. Some were very large, and but slightly under the maxima measurements given in the *Fauna*, vol. iv.

One egg was well zoned at the wrong end. Two were heavily and darkly zoned—laid presumably by the same bird.

One egg was very small, but was included as of this species, having the particular character of *C. c. bakeri* eggs.

One egg only was found to have an excessively fragile shell.

In no instance were more than two cuckoo's eggs found in the same nest; but two cuckoo's eggs were found in one nest on three occasions—and in each nest the two eggs (as is to be expected) appeared to be the produce of two different birds.

FOSTERERS.

In these States the Burmese Stone Chat (*Saxicola caprata burmanica*) is the usual fosterer for cuckoos laying the common type of egg, and the Eastern Dark Grey Bush-Chat (*Oreicola ferrea haringtoni*) for those laying the blue egg.

For these 90 eggs the fosterers were as follows:—

Saxicola caprata burmanica ...	74
Oreicola ferrea haringtoni ...	12
Melophus melanicterus ...	3
Suya s. superciliaris ...	1
Total ...	90

It may be noticed that of the 14 blue eggs, all except two were laid in nests of the Dark Grey Bush Chat, to the eggs of which they are perfectly adapted except for size. Of the remaining two, one showed traces of red marking and was found in the nest of a Stone Chat (could this be the egg of a cuckoo deviating from the ancestral habit of victimising the Dark Grey Bush Chat, laying an immaculate blue egg and now in process of adapting itself as a parasite on the Stone Chat which is a far more common bird in this part?) The other was found in the nest of *Suya s. superciliaris* the eggs of which have bluish ground colour.

The only other species of bird which I have noticed (in a previous year) victimised by this cuckoo in the Shan States is the Indian Pipit, although a number of possible fosterers abound such as the Bulbuls, Burmese Shrike, Suyas, Spotted and Yellow-eyed Babblers, etc. etc.

The eggs are well adapted to the Stone Chat's eggs and are zoned, but the greenish-bluish ground colour of the Chat's egg is not present in any egg seen.

HABITS.

In these States the cuckoos leave the hills for the plains and wide valleys in the winter. None were seen on the hills in January and February. Numbers came up in March and started calling about the middle of that month.

It is possible that the attentions of the cuckoo are not so resented by the fosterer as has been made out. Perhaps they are flattered by it. A Stone Chat was seen deliberately to seek out a cuckoo and sit beside it, showing the greatest interest, going and returning several times while the cuckoo appeared to be in a sleepy trance.

The male cuckoo seems to assist in the finding of suitable nests for his mate, otherwise it is hard to account for their persistent watching of the terrain. A male cuckoo (a calling bird) was seen to fly deliberately down to a very well concealed chat's nest and inspect it. This nest was in a deep hole and it would have been very difficult for a cuckoo to have got in and reached the nest with her head. As a matter of fact no cuckoo laid in it—and probably for that reason. His interest could not have been in any way a parental one, since it contained only the chat's eggs, and the only explanation is that he set out to find it in order to show it to his mate to gain her affections.

Nearly all these Stone Chat's nests are placed in holes and narrow little places under clods of earth and wedged in among rocks etc. where it is difficult to get one's hand in; so that it would appear impossible for a cuckoo to get her egg in by laying it in direct. The egg must be introduced into the nest by the head. A photograph of a chat's nest in such an awkward position—in a section of bamboo lying on open ground—and from which I took a cuckoo's egg is reproduced to illustrate this. In this nest I could not get my hand in to reach the eggs but had to draw the nest out to the entrance with two fingers to obtain them. The instance of another cuckoo's egg found in a nest of *Suya superciliaris* has been mentioned. It is ridiculous to suppose such nests are laid directly into—it is quite impossible.

Most likely the cuckoo conveys her egg to the chosen nest in her throat, having laid it previously in a quiet and suitable place. To carry it to the nest in her beak would be clumsy, and it would be at once noticed by crows, etc., and give rise to her pursuit. It would have also been noticed on many occasions by people who have so often seen the cuckoo fly away from the fosterer's nest with one of the fosterer's eggs in her beak (a Toungyo saw this with me this year). Nor is it likely that the egg is laid just outside the fosterer's nest, for the place is rarely flat and suitable, and the cuckoo would be liable to interruption during this process. Again it would be clumsy, and Nature is rarely clumsy. On the other hand one would expect if the egg had been regurgitated, to find it slimy and sticky. But such is not the case. Two cuckoo's eggs were obtained immediately after the cuckoo had flown away from the nest—still warm! but they were quite clean and dry. So the mystery deepens—and we can but try again.

One cuckoo's egg was brought to me by a small boy with another egg in appearance very like an English robin's egg (no—not a Forktail's!). Both these eggs he said he found together lying on the top of a tree stump a few feet up, but in no kind of nest—just lying on the bare wood. Both eggs were fresh.

A small pale egg laid by a certain cuckoo (? her first season) was found on four occasions lying 3-8 inches outside the chat's nest. These nests were no more difficult of access than other chat's nests in which cuckoo's eggs had been found. It appears to have been the habit of a certain cuckoo—and a bad habit.

To conclude with a mention of the remaining 13 cuckoos' eggs which seem to belong to four different species of parasitic cuckoos.

1. A brightly coloured pink and yellowish egg—the colouring of which reminds one of eggs of the Yellow-eyed Babbler: but the markings remind one of eggs of the Blackcap. These eggs are seven, and were found in a variety of fosterer's nests. The eggs measure approximately 21 by 14.8 mm.

Two in nests of the Shan Scimitar Babbler.
One in a nest of Salvadori's Scimitar Babbler.
One in a nest of the Indian Pipit.
One in a nest of the Burmese Wren Warbler.
One in a nest of the Crested Bunting.
One in the nest of the Yellow-eyed Babbler.

I do not yet know to which species they belong. The Himalayan Cuckoo was not seen or heard. I have not noticed it in the Shan States.

2. A cuckoo's egg found in a nest of *Suya crinigera* to the eggs of which it bears some resemblance. It is larger and broader than any eggs of the Plaintive Cuckoo I have seen. The ground colour is a dark, warm biscuit colour and it has a suffused darker zone. It measures 19 by 14 mm.

? an egg of the Bay-banded Cuckoo. These birds were on the hill.

3. Four eggs of the Burmese Plaintive Cuckoo. It is curious that though this bird begins to call early in February a month before *C. c. bakeri*, it does not appear to lay till the rains have set in, i.e., till the end of May. It is the same in the Chin Hills,

where their eggs may be found in nests of Austen's Hill Warbler during July.

Of these four eggs two were found in one nest—in a nest of *Suya superciliaris*. One egg was a long bluish egg well marked, and the other a pinkish white egg also nicely marked. The third egg was found in a nest of Franklin's Wren Warbler, and the fourth in a nest of a species unknown to me (the egg is about the size and appearance of *Suya superciliaris* but very short and capped with red and is said to have been found in a cup nest placed in the outer twigs of a tree.)

4. A deeply coloured green-blue egg, unmarked, measures approximately 21 by 16 mm.

Found in a Yellow-eyed Babbler's nest.

YAUNGWHE, T. R. LIVESEY.
S. SHAN STATES,
BURMA.
June 1, 1933.

X.—NIDIFICATION OF THE GIANT NUTHATCH (*SITTA MAGNA* WARDL.-RAMSEY).

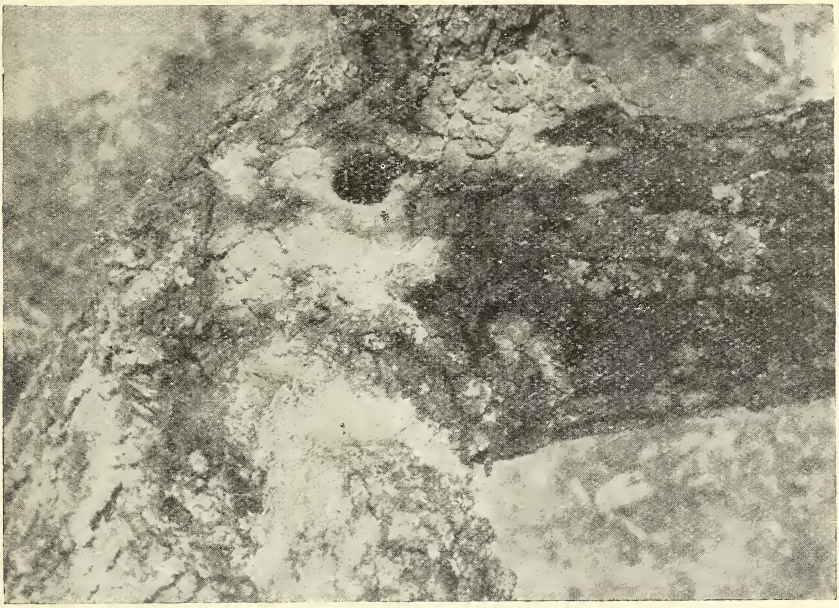
(*With a block*).

Nothing seems to have been recorded about the nesting of this magnificent Nuthatch. It is not uncommon in some localities of the Southern Shan States between 4,000 and 6,000 ft. It has a variety of loud notes, and the bold flight of a woodpecker, and so is a somewhat conspicuous bird. I have seen it in quite open country flying from one small tree to the next, and heard it utter then a curious cry like some mammal's. At other times I have noticed it flying boldly and direct with the dipping flight of a woodpecker through forest from one big tree to another uttering a call not unlike that of the smaller pied woodpeckers.

The Giant Nuthatch is well named, for he is three times the size of an ordinary nuthatch, and a bold bird that will come to see the intruder sitting generally upsidedown on the tree trunk to do so. Not so restless as the smaller nuthatches, it is not a difficult bird to watch. One of the call notes is a clear flutelike pipe, followed by a loud and harsh Get-it-up,—get-it-up—get-it-up'.

I found the nest this year on April 4, but it contained three half-fledged young ones. It was situated in a natural hole in a tree trunk some seven feet up off the ground. The hole had been rounded off slightly by the parent bird, I suppose, and opened skywards. There was no sign of any mud plastering. Evidently the nuthatch thought it would get its brood off before the rains came. From this it may be concluded that it is an early breeder and lays early in March.

The young appeared to be resting on a pad of nesting material such as nuthatches use, and were about nine inches down the hole. The entrance being barely large enough to admit the parent birds did not give me much chance of observing the young, and I was unwilling to open it out and disturb them. The whole time the parent bird was hanging upsidedown a few feet away and calling its anxiety.



Nesting site of the Giant Nuthatch (*Sitta magna* Wardl.-Ramsey).

I had to content myself with a photograph of the nesting hole. Returning a fortnight later after the young had flown I could make out a few fragments of the egg shells but these were scarcely large enough to be of any use.

Others were searched for but the season was too far advanced to give hopes of success.

YAUNGWHE,
S. SHAN STATES, T. R. LIVESEY.
BURMA.
June 1, 1933.

XI.—THE BROWN HAWK-OWL (*NINOX SCUTULATA* RAFFLES) FEEDING ON BATS.

During my stay in the Naga Hills, Assam (1930), I secured a specimen of the Brown Hawk-Owl (*N. scutulata*). This bird was quite plentiful, coming out at dusk. The flight is somewhat rapid and jerky, but when going to its perch it would plane down from a height. From time to time, the bird would make short flights from a tree and return to it or to another. After watching the bird for some time I was convinced that it was after bats that were about at the time. The specimen in question had caught a Pipistrel and was eating it when I shot it, which confirmed my suspicions.

Stuart Baker (*F.B.I.*, Birds, vol. iv, p. 456) records the following with regard to the food of this owl:—'Their food is more exclusively insectivorous than most owls but they occasionally also feed on mice, small birds, frogs and lizards and I have once found the remains of a small grass-snake in a nest.'

It is surprising to find that this bird is able to catch such fast fliers as the Pipistrels on the wing, as the flight of the latter is very rapid and jerky. The birds when catching the bats go through all possible evolutions in the air but owing to the feeble light it was difficult to follow the whole process.

BOMBAY NATURAL HISTORY SOCIETY, C. McCANN,
BOMBAY. *Assistant Curator.*
August 14, 1933.

XII.—THE NESTING ON THE SHAHIN FALCON (*FALCO PEREGRINUS*) ON A TREE.

Six years ago I was following the tracks of an old solitary Bison in the States of Karenni in Burma. Passing along the crest of a hill about 3,000 ft. in elevation and about four miles east of the Salween river a pair of 'Peregrine' falcons attracted my attention. The female—a magnificent bird—kept sailing backward and forwards before me. I noticed how dark she was—the upper plumage almost black, and the deep black of the sides of the head seemed to me more extensive than usual. She had her nest there at the top of a pine tree, and by climbing above it I was able to look into the nest and could see 3 or 4 nestlings in play down within it. The date would be about April 10.

In the *Fauna of British India*, 2nd edn.—two birds of this type are described from the Indian region—*Falco peregrinus calidus* Lath.—the Eastern Peregrine—and *Falco peregrinus peregrinator* Sund.—the Shahin. The former is not recorded as breeding in the Indian region, and is generally a paler bird than the Shahin. The Shahin breeds in India, etc. and is a dark bird. It has not been recorded as nesting on trees, however, and so this record is of interest.

It struck me that it was its own nest, and not an old one of another species used, as there were no crows or kites about that locality, and it appeared to be a well founded and new nest.

A pair of these fine falcons' nest on a precipice near where I am writing this—on the mountain range on which Taunggyi stands in the S. Shan States. It is at about 6,000 ft. These feed on the Inle Lake 4,000 ft. below—killing Pintail and Garganey Teal.

On the lake they may be seen sometimes searching for prey when it is almost dark. They never seem to attack the flocks of the Lesser Whistling-Teal, however,—I fancy because these little ducks are extraordinarily clever—or is it for the same reason I let them off myself—as bad meat?

YAUNGWHE,
S. SHAN STATES, BURMA.
April 14, 1933.

T. R. LIVESEY.

XIII.—RIDING DOWN PARTRIDGES.

A common way of catching the ordinary Grey Partridge here is to chase them on ponies or with dogs. They fly from 2 to 4 times and are then completely 'done in' and can be picked up by hand from the ground or bush into which they have run. I know of no other bird which can be caught in this manner and should be much obliged if you could tell me if this is a peculiarity of the partridge and is due to some special formation or lack of formation, of their lungs or chest.

JODHPUR,
RAJPUTANA.
May 9, 1933.

J. H. STIRLING.

[Partridges, like other *Gallinae*, a family which includes all the true land Games Birds from megapodes to quail, have strong well built legs, well fitted to progress over ground. But with the rather short, rounded wings, characteristic in all these birds, they are ill adapted to long and sustained effort in flight. Abel Chapman in his 'Retrospect' refers to a similar method of driving partridges on the Coto Donana in Spain. They are driven by horsemen through scrub and brushwood into water logged marshland and, having no line of escape between the 'devil and the deep', make stupendous efforts to fly ever higher and higher out of reach of the guns. Those which succeed are usually incapable of further movement and can be picked up by hand. 'Yet' concludes Chapman 'they could barely have covered a mile's distance after all'.—EDS.].

XIV.—HATCHING OF PARTRIDGE EGGS EXPOSED ON A TABLE.

I am writing on a subject in which I thought perhaps your Society might be interested. On Sunday morning last, 21st instant, six partridges' eggs were brought in and handed over to a poultry enthusiast, thinking they might be hatched and reared.

The latter laid them on his table, in his apartment (quite openly) and this morning (Friday) he was surprised to find that all the eggs had hatched during the night and the small birds chirping away.

This may not be unusual, but it struck me as being quite unnatural, as a great deal of trouble is essential to rear such birds in England.

2nd. Bn., The Essex Regiment, G. GRIMES.
Nasirabad, Rajputana.
May 26, 1933.

[With regard to the above note there does not appear to be anything very exceptional when we consider the temperature of Nasirabad (Rajputana) during the month of May and also that the eggs were near hatching. Exposure under such conditions would not be sufficient to chill the eggs to such an extent as to kill the life of the embryos.—Eds.].

XV.—EARLY ARRIVAL OF SNIPE IN THE ANDAMANS.

Under the above caption in the *Journal* dated the 15th April 1933, Mr. J. Miles Stapleton, I.C.S.—Deputy Commissioner of Port Blair, has written a small note. He states that he shot a couple of snipe on the 28th August 1932.

For five years I always got my first couple of brace on the 3rd September; but in the middle of August I always looked over a few well known sites, and invariably found the birds already there.

I should, however, like to mention one fact which may possibly not be known to Mr. Miles Stapleton and a good many more in Port Blair. There *are* a few places where snipe remain practically all the year round. I say practically, because I have seen them as late as the 10th April and as early as the 25th July. The places to look for them are the Dover Gardens at Haddo; around the tank below the cane fields at Haddo (this is a very sheltered place below the Jailor's Bungalow); at an oozy green patch along the borders of the rice field, near the bamboo clumps at the top end of Brigade Creek and at Manpur.

I have also on one occasion found a couple in the forest on the right hand side of the road going to Naia Shair from Sipi Ghat.

It would be most interesting to know where these birds go to from the middle of April to the end of July. Personally, I am of opinion that they do not leave the Andamans. April and the first half of May are pretty hot and dry months in Port Blair, but by the 19th of May the monsoon invariably breaks.

By the first week in September the birds are fairly plentiful all over, but these are birds that have migrated and they will be found to be in poor condition.

I was very pleased to note that Mr. Miles Stapleton mentions that the birds he shot on the 28th August 1932 were 'in excellent condition', for this goes to support my theory that some snipe do permanently remain in the Andamans.

I have had some very interesting experiences with snipe in Port Blair. On one occasion (16th March 1926) I went out to a place called Chauldari. The paddy had been cut but not all removed from the field. At one place I put up no less than seven fine fat snipe. A right and left took toll of two, while the remaining five went over a hedge right into the middle of a sugarcane field five and a half feet high. Now everybody knows that a dense sugarcane field does not afford the open space necessary for the spring or 'take off' of a snipe before he is in flight proper. When I entered this patch of cane and finally flushed the birds they rose with a fluttering—unavoidable and obvious—similar to that made by a partridge taking flight from a bush. On another occasion I came upon snipe in forest on the road to Naia Shair I had entered the forest to a depth of about 50 yards; I had really gone in to bag an Imperial Pigeon,—when I flushed these birds.

In passing I would like to mention that by the end of the first week in September snipe are fairly plentiful in the Sipi Ghat Valley, but most of these are migrant birds judging from their condition. On the 8th September 1927, Hennessey, the Senior Medical Officer, Slack, the Deputy Commissioner, and myself shot over just one field here from 4·30 p.m. to 5 p.m. and our total bag was 12½ couple, but shooting in this valley is most exhausting because of the difficult going through the rice fields, and the excessive heat.

Protherapore is undoubtedly the best snipe ground in Port Blair, for many reasons. Although it is a small area, it is easy of access—a pleasant drive along a well kept metal road, easy going through the fields, and good light for shooting. But the birds never remain in any numbers here for more than 36 hours or so, and so as soon as one has got 'Khabbar' of their arrival, it is necessary to get down to the spot with the least possible delay. One evening on my own I bagged 18½ couple here in about a 2 hours' casual shoot.

I have never adopted the habit of some Shikaris of combing the ground thoroughly up and down several times, no matter how tempting the field or oozy the patch, if it has no snipe. I remember one afternoon, I was out with a Forest Officer named Bonington and, after our shoot, we sat down on the grassy slope near the Geracharama Police Post, about 50 yards from a buffalo wallow. Suddenly we heard the sharp whistle of a snipe from this buffalo wallow, and a few seconds later three snipe dropped down there. Apparently the sound of the whistle carried up to the snipe that were flying over, on the other hand, the note can be heard for a considerable distance in the case of birds flying 100 or 150 yards up in the air, from where of course the sound would be well deflected and diffused.

Another rather remarkable trait I noticed in snipe was that they often flew away from the 'snipe ground' into the patches of 'touch me not' (*Mimosa*) plants that are spreading all over Haddo and Jungley Ghat. I think one can again trace a very good reason for this, namely protection from the wily Shikari. The little pricks one gets from these plants cause a feeling of discomfort and lead to little ulcers, so that no one who can possibly avoid it cares to tramp through a *Mimosa* patch.

There are many good grounds in the Settlement of Port Blair, where good bags can be made, for instance, the old lime gardens and the rice fields at Mamonagar. Here one forenoon with Col. Ferrar, the Chief Commissioner and a young District Officer we made a bag of 46 in about half an hour, but the going here is very tiring. In the soft slimy mud in the rice fields you sink very nearly up to the knees at every step.

With a couple of good shots, and going over two or three known areas, a bag of a hundred snipe or more could be made any afternoon. But again I must mention that on the receipt of news that there are snipe in certain fields, you must go out immediately for the birds are constantly moving on.

Behind the butts of the rifle range, I have twice put up and shot the Great Snipe (*Gallinago major*) (7¼ and 7¾ oz.) and, on one occasion close to the village in the Anny-Kate Valley, a Swinhoe's snipe. The Pintail (*Gallinago stenura*) are certainly the commonest to be got, and I have found them the commonest also in Sind and in Burma.

To digress a little I would like to mention that on two occasions, duck have been found in the Andamans. In April 1922 a jailor named E. Monin captured a Brahminy Duck (*Casarca rutila*) and in December 1927 I shot a Spot Bill (*Anas poecilorhyncha*). On both these occasions there had been cyclonic weather, so it is safe to infer that these birds were blown across from India or Burma. In April 1922 after the cyclone, one morning I saw two vultures on one of the coconut trees on the Haddo Road. Besides the Andaman Teal (*Nettion albigulare*), the Oceanic Teal (*Nettiom gibberifrons*) and the Common Teal (*Nettiom crecca*) are found in the Andamans. The Smaller Whistling Teal (*Dendrocycna javanica*) is also an inhabitant of the Islands.

On several occasions I have seen the Yellow Legged or Nicobar Button Quail (*Turnix albiventris*) at Dundas Point.

I think Swamp Partridge (*Francolinus gularis*) would thrive in Port Blair, and also the Chukor on Mount Harriat.

I took a lot of care of the Grey Partridge in the Dover Gardens, and, though I often saw coveys of from six to nine young ones, the total adult birds never seemed to increase in proportion, and the reason I am sure was the depradation of wild cats. I often wonder what has been the fate of the dozen wild fowl (*Gallus ferrugineus*) I imported from Burma and let loose at Haddo.

MEDICAL COLLEGE,
CALCUTTA.
June 10, 1933.

A. BAYLEY-deCASTRO,
Major, I.M.D.

XVI.—OCCURRENCE OF THE SHELDRAKE [*TADORNA TADORNA* (L.)] IN THE MIANWALI DISTRICT—PUNJAB.

The Sheldrake is an uncommon visitor to the Punjab and it is therefore of interest to record that there were several of these birds on the Nammal lake at the foot of the Salt Range in the Mianwali District when I was there in the middle of January this year. On one occasion I observed five, and on another three, together on the mud flats at the east end of the lake.

DANDOTE,
JHELUM DISTRICT,
PUNJAB.
April 5, 1933.

H. W. WAITE,
M.B.O.U.,
Indian Police.

XVII.—THE OCCURRENCE OF THE MALLARD (*ANAS PLATYRHYNCHA* LINN.) AT TAUNGGYI, BURMA.

As Stuart Baker in his work, *Ducks and their Allies*, vol. i, p. 152, notes but few instances of the occurrence of this species in Burma, it is interesting to record that two, a male and a female, were shot on the 13th of this month, within two to three hundred yards of the road between Yawnghwe and Fort Stedman, by a resident of Taunggyi, Major Rodriguez, late of the Medical Service—they were quite alone in shallow water.

In all my wanderings in the Shan States, I have never come across this bird, although I have heard that many years ago an officer stationed with his regiment at Kengtung bagged one or two.

The drake weighed 2 lbs. 14 oz. and the duck 3 lbs. 2 oz. She had about a dozen eggs, and judging by the size of the biggest of them, she would have been laying within a short time.

Were they going to settle and breed in these parts?

TAUNGGYI,
S. SHAN STATES, BURMA.
April 28, 1933.

S. St. C. LIGHTFOOT.

XVIII.—OCCURRENCE OF THE BAIKAL OR CLUCKING TEAL (*NETTION FORMOSUM* [GEORGI] AT KATIHAR, BENGAL.

I would like to record that while out duck shooting at Katihar (Purnea District) on the 2nd April 1933 Mr. Bruse, a friend of mine shot and winged a Clucking Teal drake (*Nettion formosum*). As it was only slightly winged he put it in his tealery, where it seemed to be doing quite well.

Both Mr. Bruse and myself have shot in the Purnea and Monghyr districts for the last 20 years, but never before have we come across this bird. There were plenty of Garganey Teal on the Jheel also a batch of Widgeon, I shot one of the latter. Is it not rather late in the season for Widgeon?

The identification of the Clucking Teal was from Frank Finn's *Indian Sporting Birds* on page 19 of which there is a very good plate of the bird.

PAKSEY, PABNA DISTRICT,
BENGAL.
April 6, 1933.

P. MURPHY.

XIX.—A TOAD (*BUFO MELANOSTICTUS*) SWALLOWING A BRONZE-BACKED TREE SNAKE (*DENDROPHIS PICTUS*).

The popular belief is that snakes eat frogs and toads. Though, of course, snakes consume other food as well, this belief is true enough to have become traditional. At any rate we may say that the snake is the mortal enemy of the frog, and most of us have had occular demonstration of this truth. We know that snakes enter bath-rooms and other damp places in search of frogs, and readily take to water in pursuit of them. No one who has ever heard it can forget the terrified scream of a frog when seized by a snake. It sounds so human and uncanny, that I think it is impossible to hear it unmoved, when one recognises what it is. I confess that I have often found myself compelled to rescue the poor little victim from its terrible fate. This is not difficult to do, because a snake, unless it is a very large one, always captures a frog by one of its hind legs, and swallows it slowly in this position, so that the wretched little creature has plenty of time to call for help, and can easily be located.

One's sympathies thus being always with the frog, it was with great glee that I once watched the tables turned. I was living in a tent in a compound in Madras. One day, I discovered that I was sharing it with an enormous toad (*Bufo melanostictus*), the biggest I think, I ever saw (it measured a shade over 6 ins. from snout to tail). We soon made friends, and in a day or two it was hopping about around my feet picking up insects, quite unconcerned by my presence. I was watching it one morning in its favourite corner, partly hidden with straw, when I became aware of a snake (*Dendrophis pictus*) about 3 ft. in length, moving along slowly in the angle at the foot of the wall. If it continued its course it could not avoid running into the toad, so the situation became exciting. When the snake was 3 or 4 feet away the toad saw it, and at once put itself into a 'fighting' attitude. The snake was apparently not yet aware of its enemy's proximity, and had approached to within about a foot, when, with a startling suddenness that made me 'jump', the toad leapt forward and seized the snake by the neck, sideways, and just below the head, with a bull-dog grip which never relaxed all through the struggle that followed. The snake made desparate efforts to free itself from its assailant but altogether failed, and after 5 or 6 minutes appeared to become utterly exhausted. The toad then with another sudden movement took the head of the snake, which was still alive, into its mouth and began to swallow it. The fight seemed over, and the toad had won. But at this point I could bear it no longer. A gentle tap on the toad's back induced it to eject the snake, which without delay turned and rapidly disappeared, apparently none the worse for its adventure!

There can be no doubt that the toad intended to swallow the snake, but though *Dendrophis* belongs to a slender family, 3 feet of it would seem to be beyond the capacity of even a very large toad. On the other hand, one often sees toads swollen to more than double their normal size after feasting on a swarm of termites.

But, however that may be, the interesting point is that, reversing all tradition, *the toad was eating the snake*!

FISCHER'S GARDENS, R. FOULKES,
MADURA, S. INDIA. O.B.E., M.L.C.
May 23, 1933.

[Toads and frogs eat any creature they can overpower—scaled, furred or feathered. We have seen a large bull-frog with his mouth crammed full of newly hatched water snakes. The Emperor Akbar, we are told, kept bull-frogs, which were trained to capture sparrows! EDS.]

XX.—SOCIAL LIFE OF SNAKES.

With reference to the article on the 'Social Life of Snakes' by Mr. S. H. Prater (*Journ. B.N.H.S.*, vol. xxxvi, p. 469), I do not know if the following incident has got any bearing on the subject and I should like to know what you think of it.

It happened some years back, though the whole incident is vividly engraved on my memory. The time was an evening in midsummer. The place was a country lane about 15 ft. wide banked high on both sides with thorn bushes. A snake, about 3 to 4 ft. long, was seen dragging another snake—apparently dead—across the road. A crowd of children had collected at a respectable distance. The snake, which was jet black, was hampered in its progress by the deep ruts and was constantly disturbed by passing cattle and bullock-carts. The snake was unmindful of the surroundings though the traffic was continuous. It was intent on getting the dead snake across the road. Once while trying to go through the thick hedge on one side, the inert snake was caught fast. When every effort to free it was frustrated, the live snake went in search of another opening. Finding a suitable passage, it came back for its load and again dragged it through the hedge. It was getting dark and hence I cannot say what happened afterwards. Whence it came with its load nobody in the crowd knew. But this much is certain; the snake underwent great risk of being crushed under the feet of passing cattle and was not scared away by the brick bats thrown by the crowd. They said it was a ♀ cobra, dragging her mate. They could not have been *in copula* because I saw the live one separated from the inert snake at least twice.

Can you offer any explanation for this strange behaviour of the reptile?

AHMEDABAD. HARI NARAYAN ACHARYA.
May 24, 1933.

[It is difficult to explain the incident. We suggest the attraction of a prospective meal. Cannibalism is frequent in snakes.—EDS.].

XXI.—FISHING AROUND AHMEDABAD.

The remark 'Near the village of Wassin-Baroda, 34 miles from Ahmedabad, along the Kaira Road, some of the finest fishing in India is available in the Subermati River' (*J.B.N.H.S.*, xxxvi, 34) is highly complementary to North Gujarat. It appears that the river meant by the authors of this excellent article is the Watrak River and not Sabarmati (nor Subermati) as the 'village Wassin-Baroda' (in fact, they are two separate villages, situated on opposite banks, Wassin, a British village and Baroda, owned by a petty chieftain) is on the banks of the Watrak, whose confluence with the Sabramati is about two miles away.

The Watrak does possess really big fish and plenty of them, though it is mainly famous for crocodiles. In a morning's walk, you come across a dozen or more of these reptiles, their snouts peeping out of water, and some basking in the sunshine. They are hunted practically all the year round and specimens of 13 to 15 ft. are not unknown.

AHMEDABAD, HARI NARAYAN ACHARYA,
N. GUJARAT. F.Z.S.
March 29, 1933.

XXII.—'BUTTERFLIES OF LAHORE'.

I have read Brigadier W. H. Evan's comment on my reply to his original note on my paper on the 'Butterflies of Lahore' (*Bulletin of the Department of Zoology*, Punjab University, vol. i, pp. 1-61, pl. i-iv, April, 1931) published in the *Journal of the Bombay Natural History Society*, vol. xxxv, No. 4, dated 15th July, 1932. I would once more emphasize the fact that only one specimen each of the four species under discussion was collected by me from Lahore. It is not certain whether those species occur in a wild state in Lahore, or the specimens I collected had been imported from elsewhere.

According to Brigadier Evans 'Mr. Antram's record of *Melitaea didyma* from the Punjab is certainly incorrect'. I may point out that the above species has been recorded from the Punjab by Bingham also (*Fauna of British India*, Butterflies, vol. i, 1905, p. 454).

Brigadier Evan's remark that the species which Mr. Rhe-Philipe missed from Lahore and which were subsequently collected by me 'have doubtless existed there for centuries' seems to imply that the butterfly fauna of a locality does not undergo any change. Such an assumption would not be in accordance with observed facts.

Government College, D. R. PURI.
Lahore.
December 5, 1932.

XXIII.—NOTE ON THE SAWFLY *ARGE PAGANA,* PAMZ VAR *VICTORINA*. KIRBY.

(*With three text-figures*).

This black Sawfly with a yellow thorax has been doing a lot of damage to my rose trees. It was a long time before I discovered the cause of numerous slits and scars on the underside of the young shoots. A short time ago I was lucky enough to find one in action. It attaches itself, head downwards, on the underside of a young shoot and inserts its ovipositor, working gradually down, making a fine slit, laying its eggs at the same time inside the slit in herring bone pattern. The slits are about ¾ of an inch long and the process takes about 20 minutes. As the eggs mature, the slit opens until it is a gaping wound, the eggs hatch out in 12

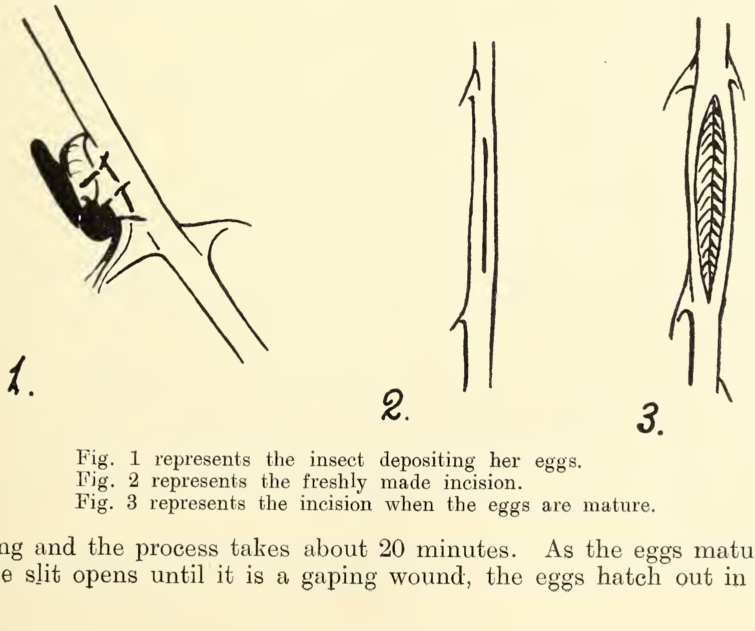


Fig. 1 represents the insect depositing her eggs.
Fig. 2 represents the freshly made incision.
Fig. 3 represents the incision when the eggs are mature.

or 13 days into minute yellowy green caterpillars with black heads, about a dozen out of one slit. They attach themselves under the tender leaves and rapidly strip a whole branch, if not detected. The shoot usually snaps off owing to the slit and the caterpillars finish the leaves that are left. I have had many rose trees stripped by this pest.

British Legation,
Nepal.
June 26, 1933.

Mrs. C. H. SMITH.

XXIV.—THE FORM OF *COLIAS HYALE*, L. OCCURRING AT AMRITSAR.

When reading Mr. D. F. Sander's note (*J.B.N.H.S.*, xxxiv, p. 591) I was reminded of some peculiarity in my Amritsar examples of this species but was unable to recall it exactly.

I have now had the opportunity of re-examining my short series of six specimens taken in 1925, and find it extremely interesting. Classification in accordance with Evans' *Identification of Indian Butterflies* is easy. There are:—

A. Two males *hyale hyale* L. taken 13-4-25.
B. Two males *ab. erate*, Esp. (=*ativitta*, M.: *glicia*, Fruhs.) taken 13-4-25.
C. Two females *ab. pallida*. Stg. taken 22-3-25 and 13-4-25.

Comparison with my French series at once shews that A is not true *hyale hyale*, the ground colour of the Amritsar specimens is of a deeper yellow and the subapical spots of the forewing more prominent. The two specimens B also have the same deep yellow ground colour.

Turning to the Indo-Australian section of Seitz's *Macrolepidoptera of the World*, I find that the two specimens A agree exactly with the description and figure of the male *glicia*, Fruhs., the original description of which is as follows:—'*glicia*, subsp. nov. is the not rare and apparently constant form occurring in Kashmir, which is conspicuous by the continuous, relatively large, yellow subapical spots on the forewing and recalls *sareptensis*, Stg. from South Russia', whilst the two specimens C agree with the figure of the female of *glicia*, which, however, is not described. The specimens B agree with the figure and description of *f. lativitta*, Moore.

Opinions appear to be divided as to whether *erate*, Esp., which Seitz treats as a good species, is really a form of *hyale* and synonymous with *lativitta*, Moore or not. There can, however, be no doubt that *glicia*, described as having particularly prominent subapical spots on the forewing, must be distinct from both *erate* and *lativitta*, which are distinguished by the absence of the marginal spots.

Basing myself on the scanty material described above, I am of the opinion that the usual form of *Colias hyale*, L. occurring in the

Amritsar district is subsp. *glicia* Fruhs. with a large percentage of the male form *ab. lativitta*, Moore (*erate*, Esp. being treated as a good species).

LONDON. D. G. SEVASTOPULO,

July 11, 1933. F.R.E.S.

XXV.—THE ENEMIES OF *DANAIS CHRYSIPPUS*, L.

Dr. F. M. Jones' very interesting paper on Insect Coloration and the Relative Acceptability of Insects to Birds (*Trans. Ent. Soc. Lond.* lxxx) lays stress on the fact that insects feeding on the *Asclepiadaceae* are unpalatable, not only to birds, but also to insect enemies such as ants. The following notes on the enemies of *Danais chrysippus*, which, in India, feeds on *Calotropis procera*, one of the *Asclepiadaceae*, may, therefore, be worthy of record.

Firstly as regards internal parasites, I have frequently bred batches of a Hymenopteron from *chrysippus* pupae and I have also bred what appears to be the same species from the Lymantriids, *Dasychira mendosa*, Hubn. and *Lymantria ampla*, Wlk., the one feeding on *Lagerstroemia* and the other on *Cassia*. The acrid juices of the *Calotropis* are, therefore, no deterrent to this parasite which also attacks larvae feeding on other families of plants.

As regards other enemies, a larva which escaped from the breeding cage was stalked and eaten by a Gecko while climbing the wall of my room.

The small larvae are very common up to the time that they are about half an inch long, whilst full grown ones are much more scarce. In captivity, however, they prove to be very hardy and deaths are extremely rare. The only possible cause, therefore, for the comparative scarcity of full grown larvae is the attack of enemies and I am firmly of the opinion that they are preyed on by ants and also by Polistes wasps.

Pupae kept in an imperfectly closed box have been attacked and destroyed by house ants.

I have no records from personal experience of attacks on the perfect insect, but the following are recorded:—

By lizards and spiders in Tenerife (G. H. Gurney, *Entomologist*, February 1928).

by sparrows in Rajputana (K. A. C. Doig, *Proc. Ent. Soc. Lond.,* 1929).

by a Gecko at Pusa (T. Bainbrigge Fletcher, *Proc. Ent. Soc. Lond.*, 1929).

by the Mantid, *Hemiempusa sapensis*, in Kenya (K. A. C. Doig, *Proc. Ent. Soc. Lond.*, 1930).

LONDON. D. G. SEVASTOPULO,

July 12, 1933. F.R.E.S.

XXVI.—ON SOME *TINGITIDAE* FROM SOUTH INDIA INCLUDING TWO NEW SPECIES (*HEMIPTERA*).

Through the kindness of Dr. T. V. Ramakrishna Ayyar of the Agricultural Research Institute, Coimbatore, South India, the writer has received a small collection of lace bugs for identification. This collection contains six species, two of which are described below as new to science.

Monanthia nilgiriensis Distant.

Coimbatore District, Bailur Forests, November 23-28, 1913, collected by Dr. T. V. Ramakrishna Ayyar; 4 specimens.

Cystoechila delineatus (Distant).

Bangalore, August 26, 1931, on a red-flowered tree; 4 specimens.

Urentius maculatus, n. sp.

Allied to *U. chobanti* Horvath, but distinguishable by the shape of the paranota and the biseriate basal portion of costal area of elytra. Whitish, each elytron with two or three small brown spots. Head armed with five, moderately long, whitish spines; brown, with white pubescence. Bucculae brown, contiguous in front, with long white hairs. Rostral channel wide, open behind; laminae armed with short spines; rostrum extending between intermediate coxae. Eyes large, transverse, reddish. Antennae moderately long, slender, clothed with a few long pale hairs, whitish testaceous, the apical half of last segment embrowned; segments I and II stout, very short; III, slender, two and a half times as long as IV, the latter fusiform and swollen distally. Paranota completely reflexed, extending to the median carina, beset with numerous long spines. Lateral carinae short, converging anteriorly. Median carinae well developed, composed of one row of small areolae. Collum narrowly elevated in the middle in front, there forming a very small, compressed hood. Elytra extending considerably beyond tip of abdomen, slightly constricted beyond the middle, armed with long spines; costal area moderately broad, mostly uniseriate, biseriate in front; areolae hyaline. Margins of elytra, paranota and median carina armed with long sharp spines. Legs moderately long, slender, the tarsi embrowned.

Length, 2.29 mm.; width, 1. 30 mm.

Type, female, Sagoda, Purma R., Buldana, Central Provinces, India, February 9, 1928, N. C. Chatterjee, in collection of author. Paratypes taken with type, and from S. India—Kistna District, Mathimuthanagudem, June-August, 1923. The brown spots are each formed by one or two coloured spines and nervelets.

Phyllontochila ravana Kirkaldy.

N. Malabar, Taliparamba, July-August, 1918, taken by P. S. Nathan. Feeds on *Vitex trifolia*.

Leptopharsa ayyari, n. sp.

Pale testaceous, with fuscous markings. Antennae moderately long, slender; segments I and II brown, thick, very short; III very slender, testaceous, enlarged at tip, three times the length of four; IV brown, considerably swollen, clothed with a few long hairs. Head brown, with five moderately long spines. Pronotum brown, triangular portion whitish, tricarinate behind; hood large, covering most of front half of pronotum, scarcely projecting anteriorly, subglobose, the nervures largely infuscate. Paranota moderately broad, biseriate, slightly reflexed, the areolae moderately large. Elytra consrticted beyond the middle, rounded and overlapping behind, nervelets marked with fuscous; costal area irregularly biseriate, with a more or less distinct band near the middle; sutural area considerably embrowned; discoidal area impressed, with three areolae at widest part, extending slightly beyond middle of elytra. Rostrum extending almost to end of rostral channel.

Length, 2.29 mm.; width, 1.10 mm.

Type, female, S. Arcot, Cuddalore, Madras Presidency, on Jasmine, May, 1931, in author's collection. Paratypes, 13 specimens, taken with the type. This insect is named in honour of Dr. T. V. R. Ayyar, Entomologist, of South India. It is very different from any known species of *Leptopharsa*, and perhaps should be placed in a new subgenus. The hood is large, subglobose and extends back a little behind the middle of the pronotum. The lateral carinae are parallel, short and terminate at the hind margin of the hood.

Stephanitus typicus Distant.

S. Malabar, January 30, 1916, collected by Dr. Ayyar on leaves of Plantain (*Musa*). Known also to feed on Cardamon plants (*Hedychium*) and allied *Scitaminae*.

AMES, IOWA,
U.S.A.
May 31, 1933.

CARL J. DRAKE.

XXVII.—A VIVIPAROUS FLY AND A CHAMAELEON.

Recently my chamaeleon caught a large viviparous fly. Soon after the fly was eaten, I noticed that the reptile showed signs of great discomfort. It appeared as though it were trying to get rid of a nasty taste. I also noticed that the fly deposited some of its larvae in the mouth of the lizard while it was being chewed. I gave the matter no further thought at the time but a couple of days later, the chamaeleon appeared very uneasy and one of its nostrils was oozing. Now and again there appeared a whitish object from the affected nostril which, on close examination, looked like a fly maggot. I tried to remove the object with fine forceps but could not as it would immediately go in beyond reach. As this method was useless I attempted an injection of salt water with a hypodermic syringe. The larva now became uncomfortable (so did the chamaeleon) and, on showing itself, was extracted. The chamaeleon was none the worse for the operation.

At the time when the larvae were deposited by the fly they were about two millimetres in length but the one I extracted was quite a centimetre long. No others appeared at this point. The larva had apparently entered the nostril through the internal nasal openings and eaten its way up the nasal passage. From this, it seems evident that even the consumption of its food may result in danger to the chamaeleon.

While on the subject it is interesting to note that large insects are not easily captured by chamaeleons, only such insects as will easily adhere to the club-like tongue. A chamaeleon is quite unable to eat large beetles for example. They invariably drop off the tongue due to their own weight. Before striking both eyes must be focussed on the object.

Bombay Natural History Society,
Bombay.
June 3, 1933.

C. McCANN,
Assistant Curator.

XXVIII.—MOSQUITO SWARMS.

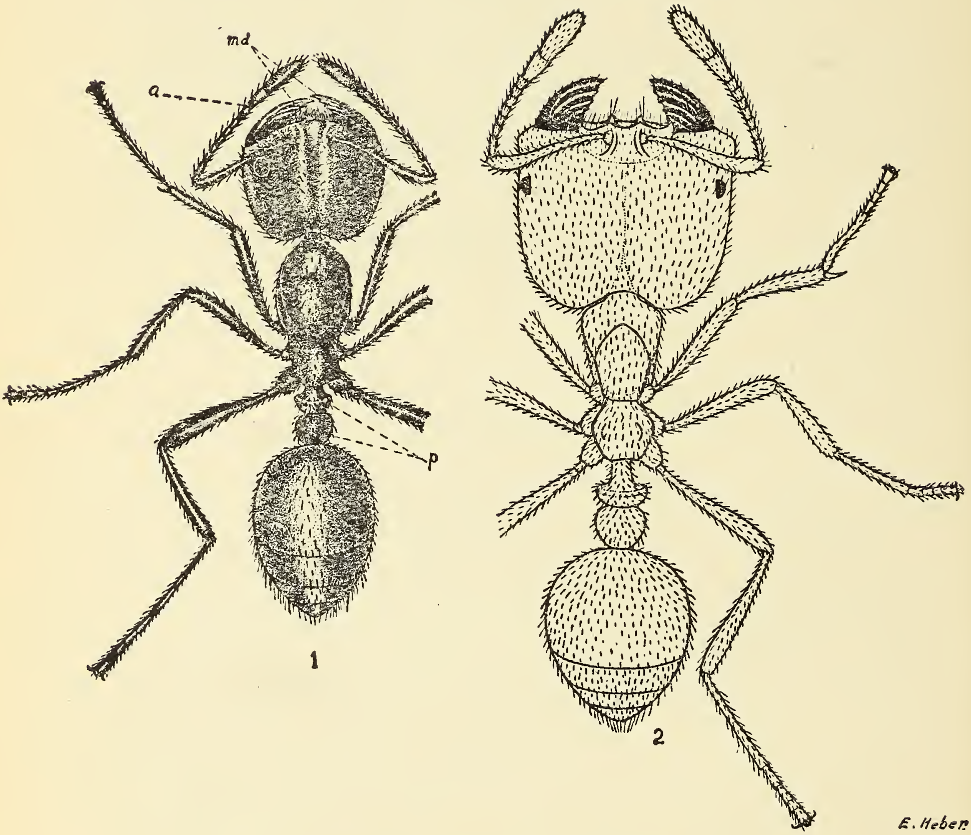
Many observations have been recorded with regard to the swarming of mosquitoes and gnats. It will be interesting to know if others confirm the following observations as to one possible explanation for the swarming of mosquitoes.

I have noticed that the small swarms seen after sunset over the heads of individuals sitting out, perhaps after a game of tennis, are all males. As a rule those wearing dark clothes are picked out, and the reason for this seems to be that the female mosquitoes select a dark background where possible to settle for a feed of blood. When a sudden movement of the victim disturbs a gorged or partly gorged female, she flies up rather clumsily and is immediately pursued by one or more of the males in the swarm and sexual union may be seen to occur in the air, or the successful male flies away to some neighbouring shrub clasped to its mate.

If this observation is correct, and I have observed it happening on various occasions, it explains one reason for the swarm, why they are all males, and why they prefer darting about above the head of an individual clothed in dark raiment. Attempts are being made to introduce a mosquito trap by reproducing by electrical means a buzzing sound which will attract mosquitoes. If the above theory is correct, the buzzing sound produced by a swarm of male mosquitoes might be copied with success and attract both male and female mosquitoes.

3, Heneker Drive,
Colaba, Bombay.
April 8, 1933.

F. P. CONNOR,
Col., I.M.S.



SOLENOPSIS GEMINATA RUFA, Jerdon.

1. Worker minor, dorsal view ×20.
2. Worker major (soldier) general outline, dorsal view ×20.

a—antenna.
md.—mandibles.
n—nest.
p—waist.

XXIX.—RHYTHMIC SOUND PRODUCED BY TERMITES AT WORK.

Is it generally known that the work done at night by termites is carried out with a regular rhythm? When I accompanied the well-known naturalist, the late Dr. N. Annandale, during his researches on ants and termites in the island of Barkuda in the Chilka Lake, I called his attention to the characteristic rhythmic sound produced by thousands of termites biting dry leaves during the early hours of the night. The pucca platform or 'chabootra' on which our camp beds were placed was covered with dry leaves and these were being eaten by termites. The sound produced by their multitudinous bites in unison resembled that of thousands of pins pricking parchment or dry leaves simultaneously, and this occurred in a regular rhythm reminding one of the timing of the rhythmic flash of swarms of fireflies on a dark night, so beautifully seen in the Terai districts after the rains.

This rhythmic sound can only be heard on an intensely quiet night and even then one must listen carefully. When once heard it is unmistakable and quite impressive in its way—a graphic record of great industry and perfect team work.

3, Heneker Drive, F. P. CONNOR,
Colaba, Bombay. *Col.*, I.M.S.
April 8, 1933.

XXX.—THE SMALL RED ANT *SOLENOPSIS GEMINATA* sub. sp. *RUFA*, JERDON, AND ITS USEFULNESS TO MAN.[1]

(*With a plate and a block.*)

The ant is widely distributed in the province of Bihar and Orissa and is also reported to occur in abundance nearly all over the tropics of both hemispheres. But in spite of its wide occurrence and use to man in more than one way, very little is known of its activities beyond its notorious bite.

In the course of my investigations from the year 1928 to 1930, I have found that the ant collects and destroys:—

(1) The lac predators and parasites in the field as well as in the lac godowns.

(2) The termites (white ants).

(3) The bed bugs.

The ant, therefore, can be used in a practical way to get rid of the aforesaid insects in the manner discussed in this note.

The ant may be recognised by the following characters:—

(1) The waist is two jointed in all the sexes.

(2) The worker minor (Pl., fig. 1) is dark reddish yellow in colour.

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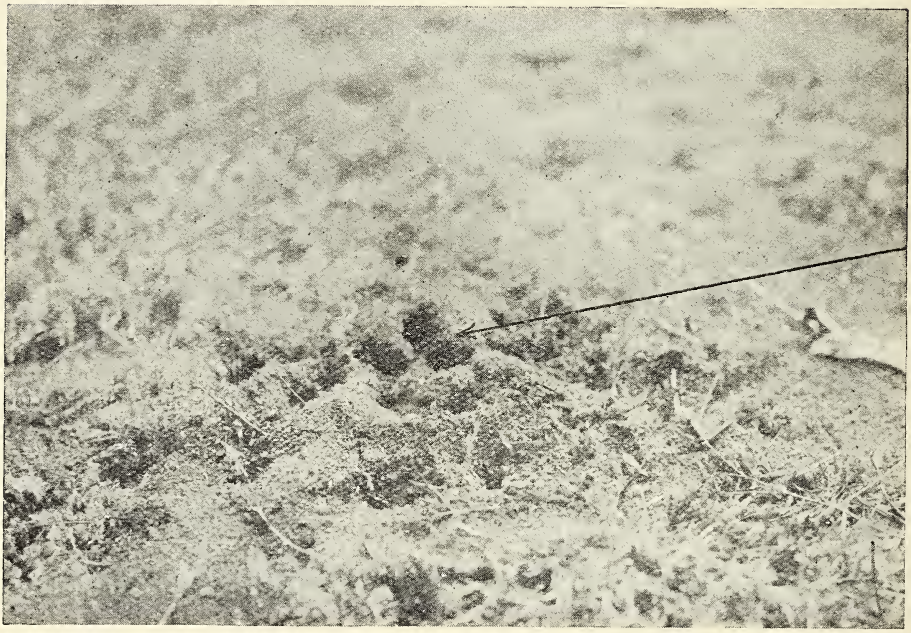
[1] This note is the modified form of the paper read at the eighteenth session of the Indian Science Congress, 1931.

(3) The antennae (feelers) are 10 jointed in the worker minor.

(4) The worker minor measures from one-eighth to one-fifth of an inch.

(4a) The worker major (Pl., fig. 2) is from one-fourth to one-third of an inch in length.



Nesting site of the Small Red Ant (*S. geminata* sub. sp. *rufa* Jerdon). The black dots show entrances to the nest.

(5) The nest (see photo) is generally situated under a tree or in the open field or at the base of the outer walls of houses. On the surface of the nest fine excavated earth is found heaped with a number of small round holes or holes of other shapes in it. The nature of the soil affects the appearance of the nest, e.g. in the rains the heap of excavated earth may not be prominent and the holes are seen in loose earth only.

(6) The ant guards its nest very cautiously and the intruder is attacked by a number of workers, each inflicting a very painful sting. The ant catches and holds the skin of the intruder with its mandibles, curls its body and thrusts the sting into the skin near the place held by its mandibles.

To check the activities of these ants the colonies should be collected and used as follows:—

Lac predators and parasites.—If the ant be absent in the vicinity of lac godowns, it should be brought in empty baskets or kerosene tins with loose earth from its nest. The earth should be heaped in a corner of the godown or in a place nearby to give the ant easy access to the lac. If the colonies are collected from more than one nest they should be kept separately. The ants will first make a nest and then attends to lac.

To make the best use of the ant, the cultivator should scrape all the lac, except the portion to be used as brood, soon after reaping from the field. The same should be done with the lac used as brood after its removal from the trees. The lac should then be spread in the godown. This prompt scraping will by itself kill a good number of the enemies of the lac insect, and a large majority of the enemies that have been exposed during scraping will be removed by the ant, which avoids the lac and dead or crushed lac insects but assiduously removes the exposed and partly exposed stages of the lac predator, parasites and scavengers. By doing so, it saves a fairly good portion of the stored lac from the damage by the predatory larvae and beetles, which feed on the stick lac and prevents a large number of the enemies of the lac insects from reaching the adult stage. These otherwise would infest the lac crop in the neighbouring fields. The ant, therefore, along with the other ants, might profitably be used for the control of predators and parasites of the lac insect in lac godowns from the time the crop is reaped to the time the stick lac is converted into seed lac.

The other household ant which is almost equally useful in removing the various stages of the lac enemies from stored lac is the common small black ant *Iridomyrmex anceps*, Roger. Its bite is not painful.

Termites (white ants):—The colonies of the ant should be brought as stated previously and let loose in the field. The white ant passage-ways should be exposed occasionally by turning over the soil at the surface to a depth of about two inches, and the termitaries should be dug up. This exposes the termites to the ant which picks them up very quickly, as they offer little resistance and carries them to its nest. I have tried and found the ant a successful check against termites in my kitchen garden, and at my suggestion Mr. P. M. Glover, the Entomologist at the Institute, tried it in his flower garden. He has recorded a summary of these observations in *A Practical Manual of Lac Cultivation* 1931. It has also been used to circumvent the activities of termites in the Namkum plantation. However, in localities where termite nests are too deep and abundant it would be more economic to kill the queens and workers in the nests by fumigation.

In addition to the ant *S. geminata* sub. sp. *rufa* there are several other species of ants which attack termites at Namkum. The most efficient of these is a black ant *Lobopelta ocellifera*, Roger of the sub-family *Ponerinae*.

Bed Bugs.—Boiling water should be poured over infested furniture and infested clothes should be boiled well in water for some time. By doing so, some of the bugs and their younger stages die, others are partly scalded with hot water and lose their agility. Furniture and clothes, after the above treatment, should be shifted directly to an open space near the nest of the ant. In places where it is not possible to do so, furniture and clothes should be removed to a separate room and the ant brought and left in the room, as suggested under the control of lac predators and parasites. The ant frees clothes and furniture of bugs and their younger stages very quickly. But if infested furniture and clothes are not treated with hot water as stated above, the ant takes more time. It generally first removes the eggs and next the nymphal and adult stages, because the latter are more agile and faster runners than the ant itself. To paralyse or disable a bug or an older nymph the individual ant may take from 15-30 minutes, but the task is performed more easily and quickly when more than one ant attack simultaneously. I would also suggest that if the ants are found visiting bedsteads or if they are used to control the bed bugs in houses, the inmates of the house should plug their ears with cotton before they go to sleep, otherwise, if the ant perchance enters the ear and is unable to crawl out it may cause a great deal of inconvenience.

I wish to express my thanks to Dr. C. F. C. Beeson of the Forest Research Institute, Dehra Dun, for suggesting modifications in the paper and to Mr. E. Heber for drawing the figures and taking the photograph.

INDIAN LAC RESEARCH INSTITUTE, P. S. NEGI, M.SC.,
NAMKUM. *Acting Entomologist.*

March 20, 1933.

XXXI.—THE ASHOKA TREE.

The vernacular synonymy in the article on 'Beautiful Indian Trees' (*J.B.N.H.S.*, xxxvi, 2) give *Ashopalava* as the popular Gujarati name of 'Asoka' (*Saraca indica*) tree. This, I am afraid, is not the case because the tree which is generally known as *Ashopalava* in Gujarat appears to be an altogether different species from the one illustrated in the *Journal*. The flowers of *Ashopalava* are creamy white—white with a yellowish tint. The leaves resemble those of a mango tree (vide specimen) and when young are a wonderful sight—the whole tree being enveloped in shining dull red foliage. The fruit (as you will see from specimen sent under separate cover) resemble unripe jujub (Guj). I think *Ashopalava* is a species of the Asoka though different from the one described by the learned authors. Here I may add that ancient Indian writers on medicinal plants describe two species of Ashoka—one with brilliant red flowers (called 'Hema Pushpa' Golden flowered) i.e. Ashoka (*Saraca indica*) proper, and the other with white i.e. *Ashopalava*.[1]

Ashopalava is also different from the Ashoka tree about which so much is written by Samskrta writers. If there is any tree which has received most attention in Samskrta love poetry, it is Ashoka. Its flowers are compared to the ruddy heels of a young and beautiful woman. A riot of colour, the very sight of these golden flowers is considered to increase passion. They form one of the five arrows of Puspadhanvan the Indian God of Love (the remaining four are the Red Lotus, Mango, *Navamallika* and Blue Lotus). Indian Plant Lore also says that the flowering of an Ashoka tree is dependent on the gentle kicking of the tree by a young energetic and beautiful damsel whose ankles are ornamented with Nupura-s. To continue, the other unfortunate (shall we call them fortunate) trees and plants which have to depend for their flowering on the sweet will of the fair sex are:—

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[1] The specimen sent by the writer was identified as *Polyalthia longifolia* Benth. and Hooker. f.—EDS.

Tilaka tree flowers when a beautiful woman glances lovingly at it.

Kuravaka (a species of Amaranth), when embraced by a lovely maiden.

Priyangu, by the gentle touch.

Bakula (*Mimusops elengi*), when sprinkled with wine from the mouth.

Mandara (Coral tree *E. indica*), by witty remarks or light pleasantry.

Champaka, when a lovely woman gently laughs near it.

Mango tree, when fanned by the gentle fragrant breath of a beautiful damsel.

Nameru (Rudraksha tree), hearing sweet music.

Karnikara, when a damsel dances in its presence.

(By the by I may mention that this strange belief in flowering of certain plants through human agency has been explained away by a Samskrta writer as the peculiar experiments conducted by experts to make plants, trees, etc., flower before their time.

The Ashoka tree also figures in religious rites. Hindus, particularly women, observe a vow called 'Tri Ratra' (for three nights) for the removal of misery and impending danger. 'Ashoka Purnima' or 15th of the bright half of the month of Phalguna (March) is celebrated in honour of the tree, as an aid to love. The 6th day of the bright (also dark) half of Chaitra (April) is observed to get happiness and the blessing of a son. The 8th of the bright half of Chaitra is also observed in honour of Ashoka.

On page 354 of the *Journal*, it is mentioned: '13th day of the month Chaitra i.e. 27th December' which clearly is a slip. Chaitra is a summer month and may correspond to April or May or both. I wonder how the authors arrived at the exact date '27th'!

HARI NARAYAN ACHARYA.

AHMEDABAD.

May 24, 1933.

XXXII.—NOTE ON THE ASHOKA TREE.

The article in the April number of the *Journal* describing the Ashoka Tree has encouraged me to write a note on uses for the fruit and flowers of a variety of this tree which have not, so far as I know, been recorded.

In Malaya there is a tree called in the vernacular *Tengelan* or *Tenglan*, which is classed by the Forest Department as a *Saraca* of an unidentified species. The illustrations on plates 19 and 20 of the flowers and fruit of *Saraca indica* (the Asoka tree) might easily pass as illustrations of those of the *Tenglan*.

The seeds of the *Tenglan* are eaten by Malays, who either place the pod in the fire and eat the cooked or half-cooked bean or take the beans out of the pod and boil them. Sometimes they eat the beans raw. Malay medicine-men utilize the sap from the bark of the tree as an astringent for the dressing of superficial wounds or ulcers. I do not think any use is made of the juices as an internal medicine.

The flowers of the *Tenglan*, which often grow on the bole of the tree, are eaten by the Two-horned Rhinoceros (*Rhinoceros sumatrensis*), which seem to appreciate them whenever they come across a tree in flower and the flowers are within their reach. I have never seen where the pods or seeds have been eaten by them, although the *Rhinoceros sumatrensis* is very fond of many jungle fruits and seeds.

Bukit Betong,
Pahang, F.M.S.
June 24, 1933.

THEODORE HUBBACK.

BOMBAY NATURAL HISTORY SOCIETY'S PROCEEDINGS OF THE FIFTIETH ANNIVERSARY JUBILEE MEETING.

A Special Meeting to commemorate the Fiftieth Anniversary of the Bombay Natural History Society was held at the Cowasjee Jehangir Hall on the 10th August 1933 at 9-45 p.m. Sir Hugh Cocke, the Sheriff of Bombay, was in the chair. His Excellency the Viceroy was unfortunately unable to be present, but a special message was received from His Excellency the Governor of Bombay, the President of the Society, congratulating the Society on the great work it had accomplished during the 50 years of its existence and wishing it all success in the future.

The election of the following New Members who joined between the 1st January and 11th August 1933 was announced:—

The Librarian, University of Michigan, Michigan; Rev. E. A. Storrs-Fox, Murree; The Principal, Presidency College, Calcutta; The University of Bombay, Bombay; Col. J. C. S. Oxley, Jubbulpore; Dr. J. D. Mistri, Bombay; Capt. L. F. Rusby, Dhulia; Col. Sir George Willis, R.E., C.I.E., M.V.O., Nasik Road; Mr. M. J. Dickins, Bombay; The Honorary Secretary, Association for the Preservation of Game in U.P., Agra; Mr. C. H. Martin, Bombay; The Secretary, Maymyo Club, Maymyo; The Principal, La Martiniere College, Lucknow; Mr. J. S. Neaves, Jubbulpore; The Honorary Secretary, Muktesar Club, Muktesar; Mr. D. Stewart, I.F.S., Haldwani; Mr. J. Ortcheson, I.C.S., Rawalpindi; Mr. M. N. Katrak, Bandra; Khan Bahadur Mian Ahmadyar Daultana, M.L.C., Luddan; The Hon'ble Sardar Sir Jogendra Singh, Kt., M.L.C., Lahore; The Raja of Awagarh, Awagarh; H. H. Thakore Saheb Shri Dharmendrasinhji of Rajkot, Rajkot; Rajkumar Digvijaichand, Heir Apparent of Jubbal State, Jubbal; Mr. Saw On Kya, M.A., Hsipaw; Mr. A. H. Stein, I.F.S., Bombay; Mr. P. V. Chance, B.A., Raipur; Raja Ambekeshwar Pratap Singh Saheb, M.L.C., Gondal; The Honorary Secretary, Rangoon Gymkhana Club, Rangoon; The Secondary College, Bombay; The Chief Conservator of Forests, Srinagar; The Registrar, Patna University, Patna; Raja Indrajit Pratap Bahadur Sahi, Gorakhpur; The Principal, Rajkumar College, Raipur; Mr. J. E. Cumming, Madras; Mrs. A. T. Ransford, Bombay; Mr. Theodore R. Hubback, Pahang, F.M.S.; The Secretary, Peshawar Club Ltd., Peshawar; The Mess Secretary, 3/1st Punjab Regt., Lucknow; H. E. Sir Herbert Emerson, K.C.S.I., C.S.I., C.I.E., C.B.E., Governor of Punjab, Lahore; Dr. F. R. Barucha, Bombay; H. E. Sir James Sifton, K.C.I.E., C.S.I., I.C.S., Governor of Bihar & Orissa; The Librarian, New Club Ltd., Calcutta; Mr. C. M. Wright-Neville, Arrah; Mr. R. N. Champion-Jones, Valparai; Mr. W. K. Langdale-Smith, Rungli-Rungliot; The Conservator of Forests, Travancore; H. H. The Maharaja Manikya Bahadur of Tripura, Agartala; H. E. Sir Michael Keane, K.C.S.I., C.I.E., I.C.S., Governor of Assam, Assam; H. E. Sir Hugh Stephenson, K.C.S.I., K.C.I.E., Burma;

Mr. G. W. Benton, Begumpet; Sardar Bahadur Sardar Mohan Singh, M.L.C., Rawalpindi; Mr. John Nevill Eliot, Ferozepore; Mrs. A. J. Smith, British Legation, Nepal; Mr. W. M. Petrie, Bombay; Mr. J. Humphrey, Bombay; Mr. G. B. Gilby, Karachi; The Chief Conservator of Forests in Mysore, Bangalore; Lt.-Col. W.C. Spackman, Bombay; Mr. C. R. H. Allworth, Bhamo; Mr. P. F. Garthwait, I.F.S., Bhāmo; The Principal, Noble College, Masulipatam; Mr. A. K. Thompson, Haka; Miss H. Coyajee, Bombay; Capt. Raja Durga Narayan Singh, Tirwa; Lt.-Col. M. E. S. Johnson, D.S.O., Srinagar; Mr. M. Ruttonji, Panchgani; Capt. J. C. Cotton, Baroda; Mr. C. C. Longstaff, Bombay; The Conservator of Forests, B. & O., Hinoo; Mr. W. R. Ward, Bombay; The Sister Superior, All Saints' Diocesan College, Naini Tal; The Secretary, Central Provinces Club, Ltd., Nagpur; Mr. Leslie Blunt, Bombay; Mr. P. B. Wilkins, M.C., D.F.C., Bombay; Capt. Robert Gove, Bombay.

Mr. P. M. D. Sanderson, Honorary Secretary, gave a brief History of the Progress and Development of the Society. He was followed by Mr. S. H. Prater, the Society's Curator, the subject of whose address was the "Problem of Wild Life Protection in India".

The text of Mr. Sanderson's speech is not published as it is proposed to issue shortly a special Jubilee Number of the Journal which will give an account of the origin and growth of the Society and provide a record of its various activities during the last 50 years of its existence.

The thanks of the Committee and Members of the Society are due to Mr. A. S. Vernay who has given the Society a special donation to meet the cost of printing this Special Number.

The text of Mr. Prater's address on Wild Life Protection appears on page 1 of the *Supplement* to this Issue. In this connection the Society must record its appreciation of and gratitude to those who have made it possible for it to publish the Supplement which deals with the Wild Animals of the Indian Empire and the problems of their Protection. Mr. F. V. Evans is paying for the large number of illustrations, coloured and black and white, which will appear with the series. A special donation of Rs. 5,000 has been received from His Highness the Maharaja of Travancore, who has recently been elected a Vice Patron of the Society, a donation of Rs. 500 from H. H. the Maharaja of Jodhpur, Rs. 250 from H. H. the Maharaja of Bhavnagar and Rs. 100 from H. H. the Maharaja of Chamba, to cover the cost of printing these articles which the Society hopes to make available for distribution.

The creation of sane public opinion on the question of Wild Life is essential to the success of any effort directed to this end. A necessary preliminary to the creation of such opinion is the spread of knowledge about our Wild Life, from this alone can come that interest which will engender a wider recognition of the need for its preservation.

The thanks of the Society are also due to all those authors who have contributed to the series of articles dealing with the subject and have so helped in the cause.

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THE WILD ANIMALS OF THE INDIAN EMPIRE

AND THE

Problem of their Preservation.

WITH A FOREWORD BY
HIS EXCELLENCY THE VICEROY.

THE VICEROY'S HOUSE.
NEW DELHI.

21st November 1933.

Having read with interest for many years the Journal of the Bombay Natural History Society I strongly commend to the notice of the reading public their series of articles on the Mammals of the Indian Empire.

The whole purpose of these articles is, as I understand it, to increase interest in all the wild life of the country with a view to ensure that necessary steps will be taken to prevent the wholesale destruction of our wild animals.

When I call to mind the vast areas in Canada (where I lived for four happy years) which are set aside as sanctuaries for this purpose, and realise that the same thing has been done in many other countries, I feel that more could be done in this country by reserving certain areas of our great forests in order to preserve in the future all the varied Fauna of India.

As a lover of Nature and one who can look back on many happy days spent in India's vast jungles, I trust that these articles may do much to achieve the great purpose which their wishes hope to secure.

Willingdon

THE WILD ANIMALS OF THE INDIAN EMPIRE.

PART I.

INTRODUCTION.[1]

The Preservation of Wild Life in the Indian Empire.

The purpose of the present series of articles is to give a general account of the Mammals of the Indian Empire.

For many years, the Bombay Natural History Society, through the medium of its *Journal* and other attractive publications, has endeavoured to create and stimulate in India an interest in the wild life of the country.

The necessity for this interest, particularly among our educated classes, is becoming more and more evident with the passing of time. During the past, extensive undisturbed areas of primeval forest, jungle and desert gave safe harbourage to wild creatures, and provided sure guarantee of their survival. But changing conditions in the country, the gradual conquest of forests and waste lands, above all, the building of new roads and the radical improvement in methods and rapidity of transport have left few areas in the Peninsula of India which are free from intrusion by Man. These factors have had and are continuing to have a disastrous effect on the wild life of the country. The danger to it has been accentuated in recent years by the enormous increase of firearms in use and by the inability of many of the Provincial Governments to enforce such laws as exist for the protection of wild animals.

In the past, similar conditions existed in most western countries. Forests were cut down, streams polluted and their live-stock exterminated to meet the needs of the moment with no thought of the morrow. Even in tropical lands, gradually permeated with the spirit of material progress, primitive Nature has had to give way little by little to invading towns and settlements. Ruthless destruction of wild life and a prodigal wastage of natural resources have invariably preceded the establishment of material and prosperous civilization. Thus the magnificent animal life of many tropical and sub-tropical lands—and our country is no exception—has been driven to its ultimate retreat in fast diminishing forests and is to-day threatened with utter extermination.

Even the great marine animals of the sea—the whales and fur-bearing seals—have not escaped this menace of extinction. The solitudes and vast spaces of the ocean have not been able to shelter them from the rapacity of man. Like the terrestrial species, they have been subjected to ceaseless persecution, made more easy by the perfection of methods employed in the destruction of life—both human and animal.

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[1] An Address given by Mr. S. H. Prater, M.L.C., C.M.Z.S., the Society's Curator, at the Jubilee Meeting of the Society held in Bombay on the 10th of August, 1933.

A Changed Outlook and Some Reasons for it.

But in recent years a gradual change has developed in Man's outlook upon the Domain of Nature. This change has been brought about partly by the spread of education and enlightenment. It is engendering a growing opposition to this wanton destruction of life, however much it may profit the destroyer. It is creating the more humane conception that it is the duty of Man to see that the wild creatures of the world are not annihilated. But apart from humanity, which in itself should impel Man to grant to lesser creatures the right of existence, there are other considerations which must influence him.

The spirit of this age, with its urge for discovery and research, with its marked tendency towards the popularization of Science among the masses and the dissemination of its truths and discoveries is fostering a widespread and intelligent recognition of the immense value to man of the myriads of species, vegetable and animal, which share with him this Planet. Today there is no educated man who does not realise that the realm of Nature provides Science with a vast and productive field for research. There is none who is not impressed with the belief that such research has given and will continue to give us results of great practical and educational value.

There are numerous investigations, anatomical, physiological, ecological, geographic and evolutionary which can only be made by the study of animal life. While considerable data has been accumulated by the study of dead specimens in museums or of the living creatures in the laboratory, the 'whence, how and where' of his existence which Man is seeking to discover cannot be discovered by these means alone. The study of the living creature under the natural conditions of its natural environment is equally important.

It is also true that there are material considerations apart from scientific. We have been accustomed to look upon Beasts of Prey as creatures to be exterminated. But with a clearer understanding of the role they play in maintaining the balance of life we know now that even predatory animals have a distinct value. They are a controlling influence against over-population by species whose unchecked increase would adversely affect the interests of Man. On the other hand, there is the utilization for Man's benefit of animal products such as furs, hides and horns which in themselves represent a valuable economic asset. Furs collected from all parts of the world and assembled in London for sale during the current year were assessed at a value of £3,000,000. There is necessity for conserving the sources of supply which are not inexhaustible. Again, Science has revealed and is continuing to reveal hitherto undreamed of possibilities in the uses of animal products and their employment in the treatment of human debility and disease. Who can say what products still remain to be discovered which will one day be of priceless value to Man? Finally the wild life of a country is a source of sport and enjoyment to its people— It gives healthy recreation to all classes and is a constant attraction to visitors. It is also a definite source of income to the State because of the revenues realised from the sale of shooting licenses and on the imports of sporting arms and ammunition. But obviously it is also an asset which may vanish without reasonable efforts for its conservation. For these and other reasons, it is now admitted generally, both in Europe and America, that the natural beauties of a country, its varied fauna and flora are an asset to its people, an asset to be protected and preserved to their own advantage and to the advantage of future generations.

What other Nations are doing to Preserve Wild Life.

It is interesting and instructive for us in India to know what other nations are doing to preserve wild life.

The movement for the protection of Nature had its origin barely 50 years ago. It is the European nations and the American people who set an example to the World as to what could and ought to be done to preserve wild life within their lands. In the United States of America, the rapid development of the country, the spread of agriculture and industry threatened the destruction of its indigenous fauna. The tragedy was averted by establishing great National Parks or Reserves which not only give inviolable sanctuary to wild animals, but also offer the people an added attraction because of their scenic beauty, their historical, geographical or archaeological interest.

These National Parks provide the means by which the clash of interests between Man and the Animal is obviated; whereby security is found for the creature without imposing undue restraint upon human progress. The idea gained ground because of the people's approval. Today, in the United States, there are no less than 40 great National Parks covering more than 3 million acres of land set aside for the protection of wild life.

This magnificent effort for the protection of Nature has its parallel in the British Empire, so rich in the varied aspects of its wild life. In Canada, in New Zealand, Australia and the Union of South Africa great reserves have been created which give shelter and security to the wild life of these lands. The Kruger National Park in South Africa is the largest in the British Empire if not in the world. It covers over 8,000 square miles of territory. No park in the world contains a more marvellous assemblage of wild animals. Quite apart from the protection given to the wild life of the country, this magnificent park fully justifies its existence by way of the yearly increasing revenues it brings to the State. The effort for the conservation of wild life has been equally splendid in Canada. Here again the public response evoked by the numerous National Parks within the Dominion has resulted in bringing in a great amount of money into the country. These measures have been taken by a race of people who are keenly concerned in the progress and development of their countries and nevertheless realise the advantage of making provision to safeguard their wild life from destruction.

Within the last 20 years other nations have followed the example set by the Anglo-Saxon peoples. Switzerland has established her splendid national park amid the scenic grandeurs of the Engadine. Italy and Spain have created similar sanctuaries. Sweden surpasses all Continental countries with her 14 national parks. Finland and Austria have established numerous reserves for the protection of wild animals. Poland and Czecho-Slovakia have created a common park on their frontiers in the region of Tatara and thus incidentally, in a common desire for the protection of Nature, they have found a happy solution of a vexed territorial problem. Belgium, if not the first in the field, has been equally energetic. The great wild life sanctuary in the Belgian Congo, known as the Parc National Albert, was created by Royal Decree in 1925 and by 1929 increased tenfold in area. Five hundred thousand acres of mountain and forest have been set apart for the protection of African wild life. This great reserve is open to the students of the world and in the years to come it will prove of inestimable value to scientists and to all who love Nature and are interested in it.

The cause of conservation has been advanced also by various International Conferences the last of which was held in Paris in 1930. In 1900, the British Government convened a conference in London of the representatives of the Powers which resulted in the London Convention for the Preservation of Animals, Birds and Fish in Africa. It was signed by the Plenipotentiaries of Great Britain, France, Germany, Belgium, Italy, Spain and Portugal, and is described as the Magna Charta of wild life in Africa. In 1913 an International Conference for the Protection of Nature was held at Berne at which 17 Governments were represented. The principal conclusions of this Conference was the decision to establish a central organization to deal with the question of Wild Life Preservation on an international basis. The war made this impossible and it was not till 1928 that the recommendations of the Berne Conference were given effect. A central Bureau, designed to develop as the pivot of an international movement for the protection of wild life was established at Brussels. It is known as the 'International Office for the Protection of Nature'.

Similarly, within the British Empire, the London Conference resulted in the foundation of the Society for the Preservation of the Fauna of the Empire, which has given a great impetus to the movement in England and the Colonies and has now for many years exercised its great influence in the promotion of all forms of wild life protection. Reference must also be made to the American Committee for International Wild Life Protection, representing a unity of the large museums in the United States and to the Dutch Society for International Wild Life Protection.

It will be seen from what has been written that in all civilized countries there is a general recognition of the need for concerted and practical measures to stop the forces of destruction which threaten wild life in all parts of the world. There is in India, too, the gravest need for such concerted action.

India's Wonderful Fauna.

In its Fauna and Flora, Nature has endowed India with a magnificent asset. An asset which cannot fail to be generally appreciated by its people if they were led to know something of its worth and interest.

All those reasons which have made the people of western countries strive for the protection of Nature within their borders apply with just as much if not more force to our country. Its wild life, in its interest, its beauty and its marvellous variety, compares favourably with that of any country in the world. There are more than 500 different species of mammals found within the Indian Empire. They include the Elephant associated in India from time immemorial with the splendour of her princely pageantry, the Gaur or Indian Bison, the largest of existing bovines, the Great Indian Rhinoceros, the greatest of all the rhinos now inhabiting the world, the gigantic wild sheep of the Himalayas, probably the largest of their race, the Swamp Deer, the Thamin and the Spotted Deer, one of the most beautiful of all deer and the Nilghai, the Four-horned Antelope and Indian Antelope or Black Buck the only representatives of these genera. The beasts of prey include the Lion and the Tiger, the most magnificent of all the great cats, and such splendid creatures as the Clouded Leopard, the Ounce and the Marbled Cat. Other species, like our Himalayan foxes, martens, gorgeous flying squirrels and silky-haired langurs are remarkable for the beauty and value of their fur. The Musk Deer and the Civets provide the musk of commerce. Other species are remarkable for the beauty of their colouring. Our little Painted Bat (*Kerivoula picta*) with its brilliant vermilion and black wings, is, without exception, the most vividly coloured mammal in the world. Peculiarity in form and structure is displayed by that strange creature the Flying Lemur, which is neither lemur nor bat but which bears the same relationship to the shrews as the flying squirrel does to the squirrels, or by the Scaly Ant-eater which, with its long scaly body, looks more like a reptile than any form of mammal. Apart from the interest in their symmetry of form, largeness of size, beauty of colouring or strangeness of structure or habits there is always that attraction and charm which the presence of wild life gives to our forests and plains—so dear to the many that live for the out-door life.

A further interest attaches to our wild life from its association with the folk-lore and the legendary beliefs of the country. It is an interest not confined to India alone, but which has spread among men of culture everywhere because of the esteem and admiration in which her Sacred Books and writings are held.

Some 30 different mammals are mentioned by name in the *Samhitas* (i.e. the four principal Vedas). Among them is the Elephant, the favourite of Indra, whose sanctity is enhanced by the belief that eight elephants guard the eight celestial points of the compass. The Langur or Hanuman Monkey is held in veneration, as is commonly known, because of its association with other warrior monkeys who helped Rama in his campaign against Ravana. The

Lion is one of the many incarnations of Vishnu; the Tiger finds mention in the later Vedic texts. The Mungoose figures in the *Mahabharata* as a teacher of wisdom to King Yudhisthira. The Deer is always associated with Brahma, the Creator and is the constant companion of the god Mahadeva. The Wild Boar is referred to as the 'Boar of Heaven'. It is told how in the primordial floods Vishnu, taking the form of a boar, raised the submerged earth from the waters and supported it on his tusks. One could cite many more references from the Sacred Books concerning the animal life of the country. But apart from this, it is of much interest for us to know that the earliest known record of measures taken for the protection of animal life comes from India. The earliest record, which we possess today, is the Fifth Pillar Edict of Asoka by which game and fishery laws were introduced into northern India in the third century B.C. In this inscription, the Emperor had carved on enduring stone a list of birds, beasts, fishes and possibly even insects which were to be strictly preserved. The mammals named are 'Bats, Monkeys, Rhinoceros, Porcupines, Tree Squirrels, *Bara singha* = Stags, Brahminy Bulls, and all four-footed animals which were not utilised or eaten'. The edict further ordains 'that forests must not be burned, either for mischief or to destroy living creatures'.

Centuries later, the Moghul Emperors, sportsmen, men of action and born observers that they were, displayed a deep interest in the animal life of the country. Their writings are full of descriptions, some in great detail, of the animals, the plants and flowers of the country over which they ruled. While Babur, Humayun, the great Akbar and Aurangzeeb display in their writings their great love of Nature, Jehangir was a born naturalist. It is said of him that had he been the head of a great Natural History Museum instead of being the Emperor of India, he would have been a better and happier man. His profuse and engrossing memoirs are a real Natural History of the animal life of India.

The Problem of Wild Life Protection in India.

We have endeavoured to show how great an asset to our country is its wild life and to give the many reasons why we should do everything for its protection. But for the protection given to the Lion in Junaghad State and the Great Indian Rhinoceros in Nepal and Assam these two interesting animals would have been exterminated long ago. The Cheetah or Hunting Leopard, once common in Central India, is now almost extinct in the wild state. The Lesser One-horned Rhinoceros and the Asiatic Two-horned Rhinoceros, once said to be common in the grass jungles of Assam and the Sundarbans have been practically exterminated in these areas. In many districts wild animals have been totally wiped out. In others, where they were once common, they are now hopelessly depleted. One does not wish to overdraw the picture. There are parts of India where the position of wild life is still satisfactory though insecure. But equally, there are extensive areas where conditions are so appalling that, if left unchecked, they must lead to the complete destruction of all the larger wild creatures which live in them. There is yet another point which must be stressed. Any scheme for the Protection of Wild Life would be incomplete without due provision for the protection of our Birds. Quite apart from a sentimental value, birds render incalculable service to Man. While certain species may damage crops, such harm as is done by birds is overwhelmingly offset by the benefits we derive from them. Without their protection, our crops, our orchards, our food supply would be devoured or destroyed by hordes of ravaging insects. Birds are the principal agency that controls the bewildering multiplication of insect life which, if unchecked, would overwhelm all life on this planet. Birds by reason of their predominating insect food are an indispensable balancing force in Nature. The abundant bird life of this country is one of its valuable possessions. Those who appreciate its value, cannot but strive for its conservation.

If we accept this principle of Conservation as it is now accepted by almost all civilized countries, what methods must we employ to give it effect? It is obvious in a country like India, where conditions in different provinces vary so greatly, the methods of conservation must also vary, but it is necessary to arrive at some understanding of the broad principles which underlie the problem. The land may be classified for this purpose into three main categories: urban lands, agricultural lands and forest and waste lands.

Agriculture and Wild Life Protection.

As far as our wild life is concerned, one cannot expect its preservation in urban lands. Nevertheless, we believe that it is time that measures should be taken for the protection of birds in urban areas. Areas actually under the control of Municipalities or local Boards could be made, with advantage, Bird Sanctuaries, where the killing of birds should be forbidden. There is need to put an end to the wanton destruction of familiar birds which takes place in the immediate vicinity of towns.

The second category—land under cultivation—provides at once the opportunity for a clash between the interests of Man and the Animal. There are two main reasons for this. Firstly, the areas under cultivation in India are extending and will continue to extend to meet the needs of a rapidly increasing population. This has increased by 35 million within the last decade! The need of increasing the available sources of food supply can be met only by the continued absorption of waste lands or forest—the natural domain of wild life. Secondly, there is the equally imperative need of protecting these cultivated areas from wild animals. The depredations of wild animals present one of the most serious handicaps the ryot has to face. In addition to loss of cattle, there is the damage done to crops and, not uncommonly, loss of human life. Therefore, whatever the views of the protectionist, this much is clear. Human progress must continue and in the clash of interests between Man and the Animal human effort must not suffer. But this problem has been faced by other countries. Cannot a reasonable effort be made to face it in our own? That an intensive development of the agricultural resources of a country may accompany a sane and adequate policy for the conservation of its wild life is shown by the measures taken to this end by all progressive nations.

If our wild life is to find protection at all, it must find it somewhere in our forests. It is often claimed that the proximity of forests to agriculture makes them a constant source of harassment to the cultivator. If this argument is pushed to its logical conclusion, the only remedy would be to remove such protection as is now given to wild animals in our forests, for it would not be possible to remove this menace entirely, until all the large wild animals in them were killed, died of wounds or were exterminated over large areas because of their inability to breed. Surely our goal is not the total extermination of our wild life—which is what must inevitably happen unless some form of protection is given to it within its natural domain. While it is essential that the cultivator should have reasonable latitude to defend his property, it is equally essential that there should be certain areas or reserves where the shooting of animals is regulated and where the laws for their protection are rigidly enforced. Such reserves exist —roughly about one-third of British India and Burma consist of Reserved Forest—but, while we have extensive forests to shelter and laws to protect it, our wild life is everywhere on the decrease. The time has surely come when it is necessary for us to review the position and to take such measures as are necessary to give real protection to the wild life of the country. It is the opinion of some that these great State-owned forests, where laws now operate for the protection of animals, are and must continue to remain the natural sanctuaries of wild life in this country and that they would adequately fulfil the purpose of protection if they were effectively warded. The correctness of this view depends entirely on actual conditions in a particular Province. The extent and nature of the forests, their accessibility, the density of the population and the extent to which cultivation surrounds them are factors which must influence the issue. It may be found that in certain Provinces the establishment of a national park or reserve, in specially selected areas, will provide the only means of giving adequate protection to wild life without hampering agricultural development. It is certain that the creation of such a reserve or national park would give a special status to it, and thus facilitate the passing of special laws made applicable to such an area. Further, the actual selection and declaration as a National Park of certain definite areas would have the practical effect of forcing on the attention of successive generations of officials the importance of saving these areas from any danger of disafforestation and of taking all practical measures for the preservation of the wild animals found within them.

The Need for a Special Organization to Protect Wild Life.

Whether our reserve forests remain the principal sanctuaries for wild life in this country or whether in some of the Provinces the purpose is affected by establishing national parks, there is need for a real organization whose sole concern will be the protection of wild animals in these preserves. Our efforts to protect wild life have failed mainly *because of the haphazard methods we employ, the lack of any co-ordinate policy and the lack of any real protective agency to carry that policy into effect.* The Forest Department which ordinarily administers the Forest laws has multifarious duties to perform and, while the Forest Officer has discharged this trust to the best of his ability, he cannot give the question his personal attention, nor can he find time, except in a general way, to control the protection of wild life in our forests. Experience of other countries has shown the need of a separate and distinct organization whose sole concern is the protection of wild life in the areas in which it operates.

Further, the existing laws, as now applicable in many of our Provinces, are obsolete. Naturally, their primary purpose is the protection of the forest rather than its wild life. These laws require consolidation and bringing up to modern standards of conservation. No better guide to our Provincial Governments seeking to amend their game laws exists than the recently issued report of the Wild Life Commission in Malaya. Volume II of this Report gives the general principles of conservation. It shows how these principles may be embodied in an Act and indicates new administrative methods, based on actual experience and on the laws of other countries. With modifications, where necessary, it will serve as a model for Protective Legislation in India.

Lastly there is the all-important question of making adequate financial provision for carrying out the work of conservation.

In these days of depression, when most Governments are faced with deficit budgets, the apportioning of money for this purpose must be a matter of difficulty but, unless and until suitable financial provision is made by the State for the conservation of wild life within its borders, the effort cannot succeed. This much is clear. Our present haphazard methods have failed. The experience of other countries indicates the system that should replace them. The effective introduction of this system depends upon money being provided to work it. In the United States and in other countries the problem of financing the work of conservation has been helped by the creation of special funds.

The recent Wild Life Commission in Malaya, which made a careful study of this aspect of the problem, strongly urges the creation of such a fund to be termed the *Wild Life Fund* and to be used solely for the purpose of conservation. The idea is that all fees which could be collected under Wild Life Enactments, including any licenses or fees for riverine fishing, as well as revenues from all sporting arms licenses, permits, duties on arms (sporting) and ammunition (sporting) should be credited to the Wild Life Fund. If any of these fees are collected by another department, then the cost of collection should be borne by the Wild Life Fund. It is the only means by which financial provision can be made expressly for the purpose of conservation. It is the only means by which the money devoted to this purpose will have a definite relation to the revenue derived by the State from wild life sources and which, therefore, can be expended with every justification upon the conservation of these sources. It is the only way to ensure an equitable system of conservation; the only way in which a properly organised department can be stabilised. It is the solution advocated in other countries and one which is equally applicable to any country which undertakes the conservation of wild life on sound lines. If the idea of creating a Wild Life Fund is not acceptable and, if we are yet serious in our intention to do what is possible for the conservation of wild life in India, then we must replace the Wild Life Fund by an alternative policy, which will ensure the allocation of sufficient money to meet the requirements of adequate conservation. It is so easy to refuse a constructive policy and then put nothing in its place. The necessity for conservation being clear, the importance of an adequate financial policy to support it cannot be ignored.

So much for the broad outlines of the problem. They resolve themselves as we have seen into the formulation of a co-ordinate policy for the protection of Wild Life in India, into the selection of suitable areas where our wild life can be protected without undue detriment to human interests, the creation of a special agency for carrying out the work of protection and finally, a revision, wherever necessary, of such laws as exist in order to help these agencies to carry out their task effectively.

It is obvious that in a country so vast as India, with its varying climate and physical conditions, methods in conservation will vary in different provinces. The Society therefore proposes to publish a series of papers by different authors on the protection of wild life in the different Provinces of India. These articles have been written by authorities who have made a special study of the problem in the areas of which they write. Their knowledge and experience enable them to indicate exactly what measures ought to be taken for the protection of wild life and how these measures can be given effect to in a particular Province.

Those who are contributing to this instructive and helpful series are:

Central India, Mr. A. A. Dunbar Brander (late Conservator of Forests, C.P.); Southern India, Mr. R. D. Richmond (late Chief Conservator of Forests, Madras Presidency); Punjab, Mr. C. H. Donald (Director of Fisheries, Punjab); United Provinces, Mr. F. W. Champion, I.F.S. (Conservator of Forests, U.P.); Assam, Mr. A. J. W. Milroy (Conservator of Forests, Assam); Bombay Presidency, Mr. G. Monteath, I.C.S.; Burma, Mr. H. C. Smith (Honorary Game Warden, Burma); Kashmir, Capt. R. G. Wreford (Game Warden, Kashmir); Hyderabad, Mr. Salim A. Ali; Mysore, Major E. G. Pythian-Adams (Nilgiri Game Association).

We have indicated what other countries are doing for the protection of wild life but it must be apparent that the measures which they have taken, whether initiated by acts of Government or by private enterprise must owe their success to the support of public opinion. There is need for the creation of sane public opinion on the subject of wild life protection in India. At present, such opinion hardly exists and even if it does, in some quarters it may be antagonistic. This is mainly because people do not know, nor has any attempt been made to teach them something of the beauty, the interest and the value of the magnificent fauna of this country. In most western countries there is a wealth of cheap and popular literature dealing with the natural history of those lands. In India such literature as exists, is either unintelligible to the average reader or sold at a price beyond popular reach. Again, in most western countries, Nature Study teaching is a serious part of the earlier stages of the school curriculum. While its main object is to develop the child's powers of observation, it creates a love of Nature and a sense of companionship with life out of doors. It is true that in India feeble attempts are made from time to time to introduce Nature Study teaching into our Primary and Secondary schools. But often such teaching as is given, deals with pine trees and acorns, with polar bears and robin redbreasts, and has little or no relation to the child's own environment. The present series of articles is therefore written with the purpose of providing a popular and well illustrated account which will give people general information about the Mammals of the Indian Empire. Its object is to arouse interest in the Fauna of the country with a view to its protection and not its destruction. It is proposed to issue this series in six parts, dealing separately with the various orders of Mammals. While the series will appear in the Society's *Journal*, separately bound copies will be available for distribution. An important and essential feature of these articles is the large number of coloured and black and white illustrations. An attempt is being made to illustrate most of the more important species of mammals found within our limits. Our ability to undertake this expensive work is due to the generosity of Mr. F. V. Evans, a Vice-Patron of the Natural History Society and one of its most generous benefactors. He is paying for these illustrations. Mr. F. V. Evans was in fact the initiator of these articles on Wild Life Protection in India. It is a subject in which he has always interested himself and the great encouragement and very material assistance which he has given to the Society in advancing this cause must earn for him the gratitude of all those who are interested in this question. Our thanks are also due to the American Museum of Natural History, New York, and to the Field Museum, Chicago, for permission to use some of the pictures which accompany these articles. Acknowledgements are due to Mr. Pocock of the British Museum and to Mr. W. S. Millard for the help they have given in supervising the preparation of the illustrations.

The Society hopes that these articles will do something towards drawing the attention of people in India to the magnificent heritage which Nature has given them in this country. It hopes they will help them to realise the need for preserving this legacy to their own advantage and to the enjoyment of generations to come, who with the spread of education will be in a better position to appreciate its worth than we are today.

PART II.

The Distribution of Mammals.

In the distribution of its Wild Life few regions of the Earth exceed British India in interest. The Indian Empire covering an area of approximately 1,800,000 square miles displays in its physical characters and in its temperature and climate the most remarkable variation. Its widespread frontiers include the Himalayas, soaring for thousands of feet above the level of perpetual snow, the deserts of Sind and Rajputana, the luxuriant rain swept forests of Assam and the Malabar Coast, the cold and arid plateaus of Ladak and Tibet.

Across our northern frontiers stands the chain of the loftiest mountain range in the world, while our shores are washed by an ocean which stretches south to the bleak Antarctic forming an insuperable barrier to the dispersal of our wild life.

It is proposed before describing the mammals of the Indian Empire, to give a picture of the varied conditions under which they live—these conditions being the factors which influence their distribution.

Animals are dependent directly or indirectly upon plants for their food. The vegetation of a country is therefore one of the main factors which influences the character of its animal life. But the type of vegetation, which will grow in any country, depends upon its climate and the climate upon its physical features—the level of the land, the presence or absence of mountain or hill ranges, the height and aspect of these ranges. Hence the distribution of animal life upon this Earth, as we know it today, is based entirely upon the changes which have taken place in its surface through the long ages of its history.

All through time the surface of the Earth has been changing. Mountain ranges stand in areas once submerged beneath the sea. Expanses of land have broken up to become separate continents, divided by oceans, and on the other hand dividing seas have receded to form continuous stretches of dry land.

It is believed that during the early part of the Tertiary epoch the Peninsula of India—the triangular tableland which stretches from the highlands of Central India to Cape Comorin—was a large island. This island during a still more remote period was perhaps united to Africa. But during the Tertiary period it was separated from the mainland of Asia by shallow seas which covered the plains of northern India and the whole of Kashmir. The Himalayas and the greater part of Tibet, formerly submerged beneath the sea, were then a land of moderate elevation drained by great rivers, which flowing east and west poured their alluvium and silt into the adjoining seas. During the millions of years that elapsed, while no great changes have been traced in the ancient island, the whole of those gigantic forces which created the great Himalayan ranges exerted their influence. They raised the land and drained the seas covering Assam and gave birth to the Eastern Himalayas. Thus was formed the first land connection between India and the Continent of Asia. Thus was provided a land bridge by which all the forms of life developing in Central Asia were able to enter and colonise the Indian Peninsula.

It is believed that after a great interval of time, a second upheaval took place. It produced the main Himalayan ranges and converted what was left of the intervening sea into the plains of northern India. After an epoch of quiescence, a third upheaval crumpled and ridged up a strip of this plain to form the outer ranges of the Himalayas—the group of hills known as the Siwaliks. So was formed in the course of ages the Sub-Continent of India.

What animals inhabited the country during this distant era? The remains of extinct creatures discovered in the upper layers of the Siwalik range and in other parts of the country give us a glimpse of a wonderful wealth of animal life during the Tertiary epoch. Mastodons and great herds of elephants of various species trumpeted and tramped through the swamps and reedy forests of this region. With them lived hippopotamus, rhinoceros of various kinds and a colossal four-horned ruminant the *Sivatherium.* There were troops of giraffe, of large and pigmy horses, camel, herds of wild oxen, buffalo, bison, deer, many kinds of antelope, wild pig and pig-like creatures. Further, the fossil beds reveal the existence in the Siwaliks of chimpanzees, orang-outans and baboons, of langurs and macaques. The beasts of prey included a type of cheetah or hunting-leopard, sabre-toothed tigers and various large and small felines; wolves, jackals and foxes, civets, martens, ratels and otters. The bears were represented by a species similar to our sloth bear, the rodents by various genera including bamboo rats, mole rats, porcupines and hares.

A striking fact, emerging from the comparison of the fauna of the past with that of the present, is the wonderful variety of forms which lived in those remote times and the relatively fewer forms of our day. It must be remembered that our records are incomplete. Yet we know that eleven different species of elephants and mastodons lived in the Siwaliks as compared with the solitary living form we have now. There were 6 different species of rhinoceros and several representatives of the wild boar, some of gigantic dimensions. The beasts of prey were also more numerous than those now living in that region.

This marked impoverishment of the Fauna is not peculiar to India. The remains of extinct animals unearthed in various parts of Europe, Asia and North America reveal a similar loss.

It is interesting also to note how many forms of life akin to those of that distant epoch still continue to flourish in India after millions of years. Langurs, macaques, various species of felines, hyaenas, jackals and foxes, sloth bears, ratels, mole rats, porcupines, hares, rhinoceroses, bison, and elephants allied to those which lived in the Tertiary age, still live in this country; how many again still inhabit other regions of the Earth though no longer found in India? Chimpanzees, baboons, hippopotamus and giraffes, eland, kudus and other antelope survive in Africa, though not in India. A considerable affinity has been traced between the fauna of the Siwalik period and the wild animals now living in India and Africa. Rhinoceroses, elephants, antelopes, various species of felines, hyaenas, jackals, foxes, ratels, mungooses and several forms of rodents exist in both countries. It is believed that a very large proportion of the animals which formerly existed in the Siwaliks and the allied species now inhabiting Africa and India were derived wholly or partly from the same ancestors, which may have originally migrated southward from Europe and Central Asia. The remains of extinct animals discovered in Europe and Central Asia show that elephants, rhinoceroses, hippopotami, tapirs, antelopes, lions and tigers once inhabited these regions. During this epoch it is believed that the northern countries enjoyed an almost tropical climate. But owing to a change in climate and other causes all those forms of life which were unable to adapt themselves to changing conditions perished or migrated southwards.

It is well known that during the latter part of the Tertiary Era the climate of Europe was becoming gradually cooler and that this refrigeration ended in a Glacial Epoch or 'Ice Age' in which the northern countries were subjected to an Arctic climate. The 'Ice Age' also produced glacial conditions in the Himalayan region, but whether these conditions extended into the Peninsula of India is not known.

It is assumed that all forms of life inhabiting the countries so affected were compelled to adapt themselves to the changing conditions, to migrate or perish. Some were able to react to the new conditions, many were exterminated, while others migrated southwards to colonise warmer tropical countries. Thus is explained the disappearance of numerous forms of life from the Northern Hemisphere and the Himalayas and the survival of their descendants both in India and Africa in our time.

Many forms of life, represented in the older fauna, disappeared from this country. Their place appears to have been taken by others which subsequently migrated into India from the countries lying to the east of the Bay of Bengal. Many Indo-Chinese mammals, not represented in the older Siwalik fauna, are believed to have migrated into India from the hill ranges of Assam and the countries further east. The majority of them settled in the Eastern Himalayas, while others spread through or colonised parts of the Peninsula. About 70 per cent of the mammals living in the Himalayan forests between Kashmir and Bhutan are found equally in the hill forests of Assam, Burma, South China, while some Malayan types, like the Mouse Deer and the Lorises, inhabit parts of the Peninsula. A stream of migration has also come from the West. Such species as the Indian Lion, the Indian Gazelle and the Oorial of the Punjab and Kashmir from their westerly range or their affinity with species inhabiting regions lying to the west are believed to have extended into India through her western frontiers.

Thus we see that the wild life of India is derived not only from species which were indigenous to it, which are found in no other country in the world, but also from forms, descendants of ancestors that have migrated into India from the regions which adjoin its borders. It is composed of an admixture of Indian, Malayan, Ethiopian and European elements. These foreign forms naturally predominate in parts of the country most suited to their habits. The Malayan forms abound in the damp sheltered forest clad valleys of the Eastern Himalayas and occur again with frequency in the rain swept forests of the Malabar Coast. The fauna of Kashmir, and the Higher Himalayas is marked by a predominance of European types. The main Peninsula is described as the home of the true Indian fauna. The desert tracts of Sind and the Punjab shelter an animal life somewhat uniform with that of the great Palaearctic Desert which extends westwards from Sind to the shores of northern Africa.

With this brief review of some of the factors which influenced the character and composition of the Indian fauna we may now consider its present general distribution.

India with south-eastern Asia forms part of the Oriental Region, one of the six great Zoological Realms into which the Earth has been divided to study the distribution of its animal life. Each of these Realms supports its characteristic animal life. That the animals and plants of one country or group of countries may differ from those of another must be apparent to most people. But the Indian Empire, while it forms part of the Oriental Region, presents in itself such contrasts in physical characters, such variation in climate and vegetation that its animal life naturally varies with conditions in different parts of the country.

This vast Empire has been divided into various zones or subregions each of which supports its characteristic assemblage of wild animals. There is no sharp line of demarcation between these zones. It would be difficult to plot them out exactly on a map. The animal life of one zone merges imperceptibly into that of another and there are widespread species which live in one or more zones. But on the whole it may be claimed that the animal life of a particular zone is sufficiently distinctive to be distinguishable from that of another.

THE HIMALAYAN SUB-REGION.

The Himalaya Mountains, enclosed by the Indus in the West and the Brahmaputra in the East, support an animal life more or less distinct from the rest of India. But the great range of altitude of these mountains has naturally resulted in marked peculiarities of distribution in its plants and animals.

Three distinct zones, each with its characteristic assemblage of animals, are now recognised. The first covers the whole of the forested slopes of the Himalayas from the eastern frontiers of Kashmir to Bhutan. The second includes the Western Himalayas from Kashmir and eastern Ladak to Chitral, the third the arid plateaux of eastern Ladak and Tibet. The bare towering peaks above the tree line and a strip of upland grass country which lies between the main Himalayan Range and the Plateau of Tibet is regarded as a transition zone. Here the animal life of the Himalayan forests merges into one which is characteristic of Europe and Central Asia.

The foothills and lower valleys or 'dhuns' of the Forest Zone are covered with dense tropical vegetation. These lower forests are inhabited mainly by animals which are found in the forests of the Peninsula. Tiger, elephants, gaur, sambhar, and muntjac are common. In the swamps and forests of the Terai—the strip of low lying country which adjoins the foothills—gaur are replaced by buffalo, and cheetal, hog-deer and swamp-deer are found.

When an altitude between 5,000 to 6,000 feet is reached the character of the vegetation changes. The forests become dark and gloomy. Oaks, magnolias, laurels and birches covered with moss and ferns replace the sal, silk-cotton trees, and giant bamboos of the foothills. At an elevation of about 9,000 to 12,000 one enters forests of pine and fir trees, of yew and juniper with an undergrowth of scrubby rhododendrons and dwarf bamboo. We enter a temperate zone with a temperate vegetation. But there is no sharp line of demarcation between the tropical and temperate forests. The transition from one to the other is gradual; much depending on the height of the intermediate ranges and the depth of the inner valleys. In the Eastern Himalayas, exposed to the full blast of the monsoon, tropical trees reach higher levels than in the colder and drier climate of the Western Himalayas. The animal life of the temperate zone is distinguished by the absence of many species which inhabit the Indian Peninsula and by the presence of many Indo-Chinese forms, which do not occur in the Peninsula, but are common in the hill forests of Assam, Burma and Southern China. Racoons, hog-badgers, ferret-badgers, crestless porcupines, and those curious goat-antelopes the goral and the serow are some of the typical inhabitants of these temperate forests. They are not found elsewhere in India but range widely in similar forests through Assam and the countries further east. The Indo-Chinese element in the fauna is very marked in the Eastern Himalayas but, as one travels westward, it gradually disappears, until in Kashmir and the countries further west, it ceases to be the principal constituent. The probable colonization of these forests by emigrants from the hill ranges of Assam has already been commented upon.

The second great zone of the mountain system extends from Kashmir and Western Ladak to Chitral. The Indo-Chinese mammals of the Central and Eastern Himalayas are here replaced largely by Indian species and by an infusion of forms allied to European and more northern Asiatic types. Many animals living in the plains of India are or were found in this zone among them the Muntjac, the Blackbuck and the Chinkara. The Sambhar is absent. The most distinctive deer is the Kashmir Stag, a relative of the Red-Deer of Europe. Again, typically northern animals, such as the Ibex and Markhor range through these western mountains, but, like the Kashmir Stag, do not extend into the Eastern Himalayas. The Oorial or Shapu is also not found

By courtesy of *R. B. Holmes & Co.*

Himalayan scenery above tree line.

By courtesy of *R. B. Holmes & Co.*

Himalayan scenery at the edge of the tree line.

far beyond Kashmir but extends its territory westward through the Punjab, Baluchistan and Afghanistan to the Persian hill ranges. Kashmir appears then to have received its fauna from the Indian Peninsula and the countries lying to the north and west.

The bare peaks above the tree line and the strip of luscious grass country lying between the mountains and arid plateaux of Tibet is described as a transition zone—a meeting ground between the animal life of the Oriental and the northern or Palaearctic Regions. It is obvious that the huge mass of the Himalayas must be a great barrier to the free migration of animals. This obstacle combined with the great difference in climate north and south of the range has resulted in a fairly sharp line of demarcation at about the 28°, between two distinct faunas—the Oriental in the south and the Palaearctic in the north. Evidence of this is particularly marked in the Eastern Himalayas. Here north of this line live such typically northern animals as moles, water-shrews, mouse-hares, marmots, musk-deer and the bharal, while south of it, the forests are inhabited by typically Oriental animals like flying-foxes, fruit-bats, tree-shrews, civets, mungooses and Oriental squirrels.

The Tibetan Plateau together with the Eastern Ladak is regarded as a distinct faunal area. The zone does not include the low lying wooded portions of eastern Tibet but covers the barren hills and plains which lie beyond the Himalayas but within the northern frontiers of India from Kashmir to Bhutan. It is a windswept region of scanty rainfall, intense cold and high elevation and is described as the only region of the globe where desert and arctic conditions prevail. The Wild Ass, which is found in various desert parts of Asia, lives in this zone which also shelters the Arctic Hare. The Great Tibetan Sheep, the Bharal and the Yak are also typical inhabitants of these cold, desolate and barren mountains. So much for the wild life of the Himalayan Region. Its great range of altitude and variety of climate and temperature; its vegetation ranging from tropical to alpine and its geological history make it one of the most interesting zoological regions in the world.

Assam and Burma are included in the same zoological province as the forest region of the Himalayas. There is the same gradation from tropical to temperate vegetation though the purely Alpine flora of the higher Himalayas is largely absent. The distribution and character of the animal life is similar, except in Tenasserim, where the fauna is distinctly Malayan in type. These Malayan types are traceable all through the province into the hill ranges of Assam, with an intermingling of peculiar forms. Of the wild animals of Burma some, like the Gaur, are identical with those of India, others, like the Sambhar or the Thamin, are regarded as Burmese representatives of Indian forms.

THE MAIN INDIAN REGION.

India proper from the base of the Himalayas to Cape Comorin, with the exception of the Malabar Coast, is regarded as a single sub-region—the cis-Gangetic or Indian Peninsular sub-region. The northern part of this sub-region comprises the alluvial plains of the Ganges, the Indus and the Brahmaputra rivers and their tributaries. It covers the greater part of the Provinces of Assam, Bengal, Bihar, the United Provinces, the Punjab and Sind. This immense tract of level land from 90 to 300 miles wide and stretching for 1,400 miles from sea to sea separates the main Indian Peninsula from the Himalayas. South of the Gangetic Plain, the Peninsula takes the form of a triangular tableland; varying in altitude from a thousand to three thousand feet, broken up at intervals by the valleys of its intersecting rivers. The northern side of the tableland rests on confused hill ranges known collectively as the 'Vindhya Mountains'. Its two other sides are formed by the Eastern Ghats, stretching in fragmentary spurs down the Madras coast and the Western Ghats, which form the great, almost continuous, sea wall of the Bombay Presidency. The face of the triangular plateau is scarred with scattered peaks and hill ranges—outliers of the Ghats. The most notable are the Nilgiris, the Annamalais and the Pulni Hills of Southern India.

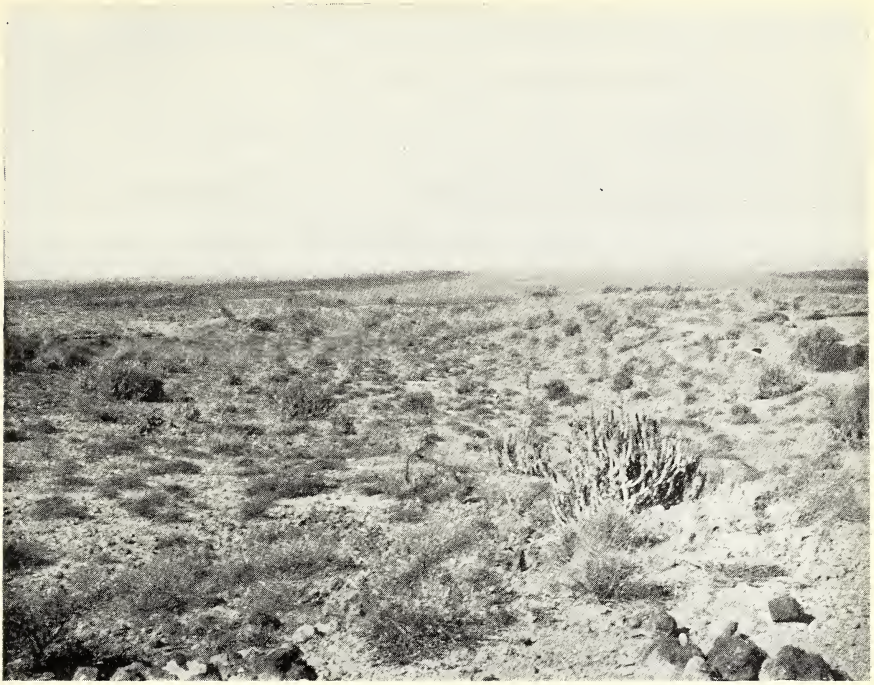
The animal life of the Indian Peninsular region is characterised by the absence of many of those Indo-chinese species which are so abundant in the hill forests of the Himalayas. It is the home of the true Indian fauna of which, the Spotted Deer, the Nilgai, the Blackbuck, the Four-Horned Antelope and the Sloth Bear are typical representatives. They are found nowhere else. Other species like the Gaur, the Sambhar and the Muntjac occur both in India and the Malay countries.

The Indian Desert Region.

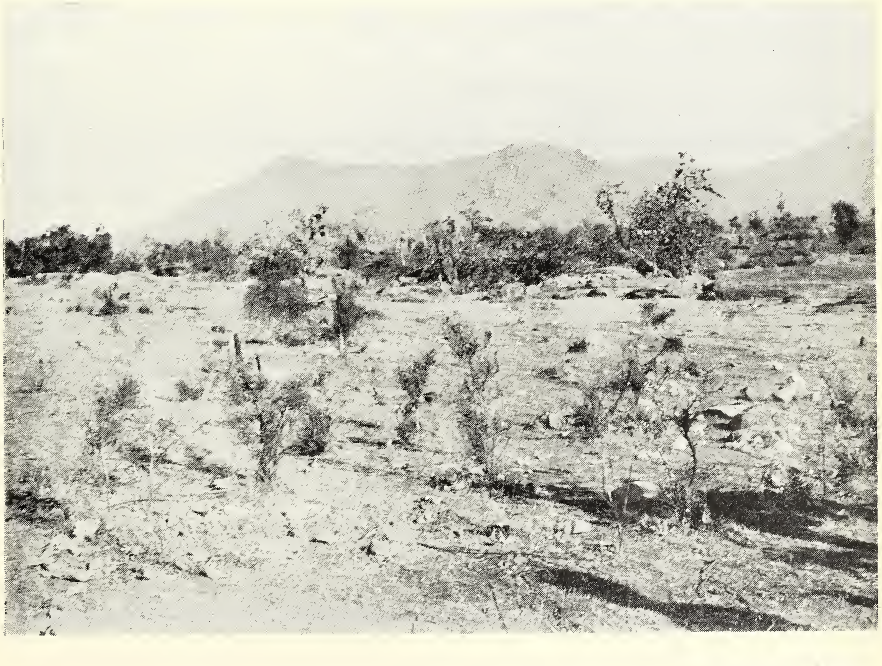
The Trans-Indus districts of the Punjab, Western Sind and Baluchistan really form the eastern limits of a great desert region which extends through Persia, Mesopotamia and Arabia to the shores of North Africa. Naturally the character of the wild life of the Indian Desert region differs markedly from the rest of India. It consists mainly of species which have migrated into it from the desert lands lying beyond its borders, and of species from the Peninsula which are able to live under the conditions prevailing in these arid and sandy wastes.

The Gangetic Plain.

The general distribution of animals in the Indian Sub-Region corresponds to a large extent with the character of the vegetation which is again dependent on variations in climate and soil. In the great plain of the Ganges the rainfall is moderate and the winter temperature is correspondingly low. In the north-western portions of the Plain, in the Punjab and Western Rajputana the vegetation gradually merges into that of the adjoining desert zone. In this area live many desert forms of animals such as the desert cat, the desert fox, the desert hare and various species of desert gerbilles—colonists from the desert zone. These desert forms disappear as one travels eastwards into the more humid part of the Gangetic Plain. A feature of the dry zone of the Gangetic Plain



Sind : Typical desert vegetation.



Photos by C. McCann.

Rajputana : Semi-desert vegetation.

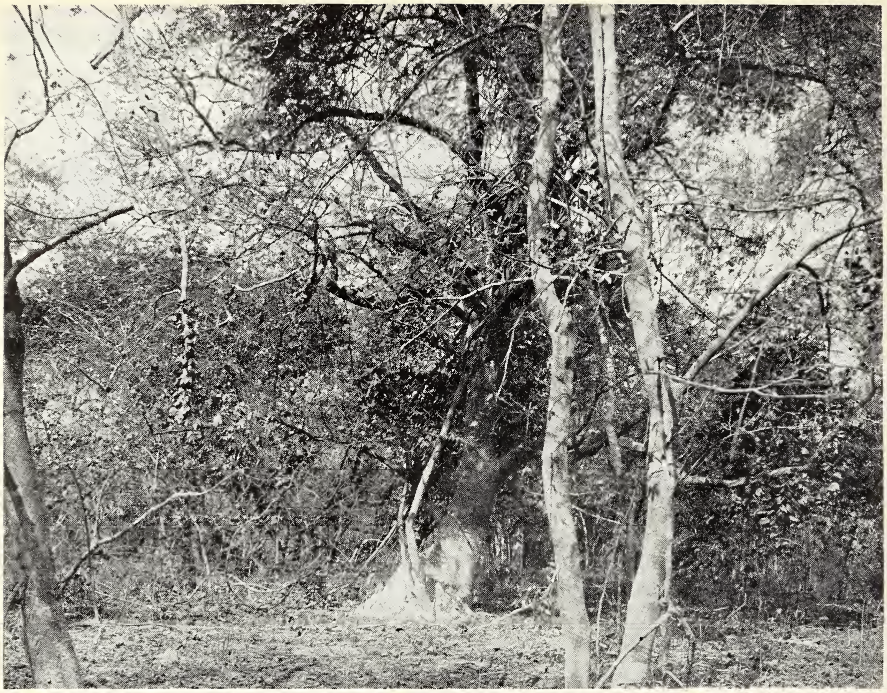


Photo by C. McCann.

United Provinces : Open deciduous forest.

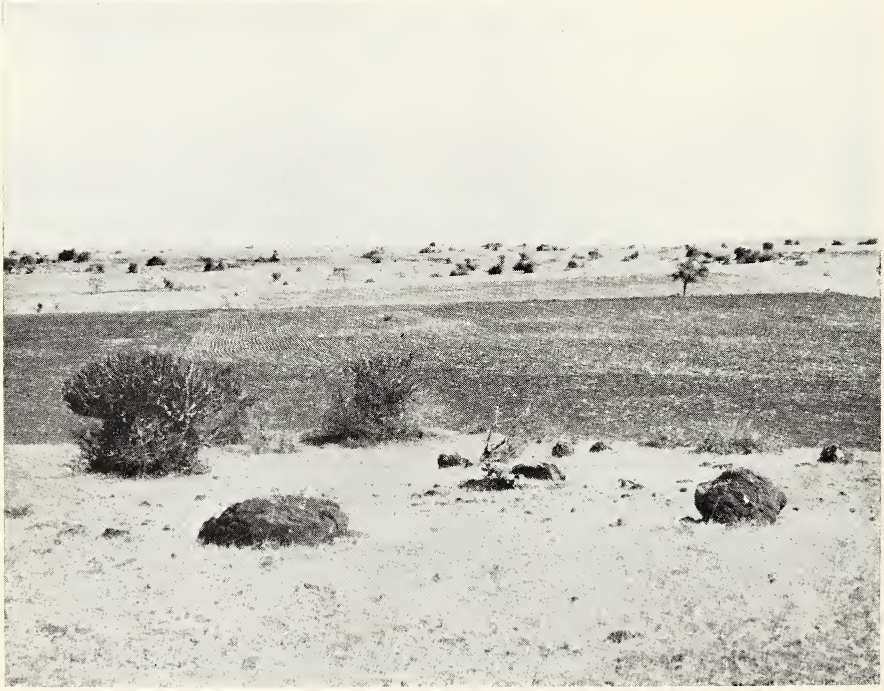


Photo by Salim A. Ali.

Deccan Trap country : Typical vegetation and scenery.

is also the presence of large herds of antelope and gazelle. In the humid plains of Bengal, the semi-desert vegetation of the northern plain gives place to luxuriant groves of mangoes, figs and palms, such as one finds in the moist coastal tracts of the Peninsula. The wild life of this humid area differs little from that of the moister and more cultivated parts of the Peninsula. Further east, at the mouths of the Ganges, the great plain is transformed into a wilderness of swamp and forest,—the Sunderbans. It is a region of grassy savanahs and muddy islets covered with mangroves and dense evergreen forests. These forests shelter most of the larger animals found in the forests of the Peninsula with the addition of swamp-deer, buffalo, rhinoceros and such animals as have a preference for this amphibious terrain.

The Main Peninsula.

While the drainage areas of its intersecting rivers are covered with green woods and cultivation, the greater part of the tableland, which forms the main Peninsula of India, presents a scene of wide undulating plains separated by ranges of flat-topped hills. A portion of the plateau, comprising the eastern parts of Central India, Gujerat and the Deccan is sheltered from the monsoon by the great wall of the Western Ghats. It is a dry region of moderate rainfall. This dry zone extends to the low lands of the Carnatic and stretches south to the plains of southern India. These are again cut off from the monsoon by the southern hill ranges. The dry zone of the tableland has its characteristic vegetation due to climate and to soil. From the Bombay coast to the neighbourhood of Nagpur, from below Belgaum to Goona in Central India, over some 200,000 sq. miles of country, black cotton soil predominates. It is derived here from the underlying volcanic rocks known as Deccan Trap which forms the unbroken substratum throughout this area. Black soil produces its characteristic wild and cultivated vegetation. The wide grass-covered plains and the bases of the flat-topped hills in the Trap country are scattered with clumps of thorny acacias, species of *Zizyphus*, small trees and shrubs which are either leafless or burnt up in the hot weather. Forests, where they exist, are mainly deciduous and composed of stunted teak, bamboos and sundry small trees. In the open grasslands and scrub jungle, herds of gazelle and antelopes are again common. Other typical animals of the open country in the Peninsula are the Jungle Cat, the Common Fox, the Common Mongoose, the Indian Wolf, palm squirrels, hares and a variety of field rats and mice. Gaur, sambhar, spotted deer, sloth bear and wild dogs are found in its open deciduous hill forests. As one leaves the Trap country and penetrates the humid region lying north and east of Nagpur, one enters a zone where the climate is somewhat similar to the plains of Bengal, the character of the soil and of the vegetation changes. Teak ceases to be the dominant tree of the forests. It gives place gradually to Sal, while the familiar crops of the Trap country millet, pulses, and cotton yield to watery rice and cane fields. The wild life of the forests of this humid zone is enriched by the presence of wild elephants, buffalo and swamp-deer, which occur in this area.

THE MALABAR COAST.

The Western Ghats, in sharp contrast to the adjoining dry zone of the Deccan, presents a region of great humidity and heavy rainfall. The forests covering the western slopes are at times very dense and composed of lofty trees, festooned with numerous perennial creepers. Bamboos form a luxuriant undergrowth. In parts of the range, the forests are more open and the banks of clear streams running through them are covered with spice and betel groves.

The Nilgiris, an off-shoot of the Western Ghats, rise precipitously to form extensive grassy downs and tablelands seamed with densely forested gorges or *sholas*. They are composed of tall evergreen trees with a dense undergrowth. Sholas, similar to those of the Nilgiris, occur in the Annamallai, Pulni Hills and other South Indian ranges. They provide the main shelter to wild elephants, gaur and other large animals of these hills. The most interesting feature of the higher level forests of the Nilgiris is their affinity to the higher forests of the Assam hill ranges. Many of the trees found in these high sholas and some of the forms of animal life are common to both areas. The forests of the Western Ghats and the South Indian hill ranges have a richer fauna than the remaining areas of the Peninsular Region. Among the species limited to these forests are the Nilgiri Langur, the Lion-tailed Macaque, the Nilgiri Brown Mongoose and the Striped-necked Mongoose, the Malabar Civet and the Spiny Mouse. In the higher levels of the Nilgiris and the Annamallais are found such characteristically Himalayan animals as the Thar and the Pine-Marten.

From this general description of the composition and distribution of the mammals of the Indian Empire and of the varied conditions under which they live, it will be seen that they share with all other living things the strong natural tendency to increase their sphere of action, to extend their territory. We find animals which have originated in countries beyond our frontiers or in our northern mountain ranges extending their range and colonising the Peninsula. When a species thus spreads into a new territory, where the climate, the vegetation and the enemies it has to face are different from its original home, it must either adapt itself to these changed conditions or it will fail to establish itself. These different conditions may produce differences in its appearance and habits, in other words, produce a variation from the typical parent form. If these colonists are subsequently isolated from the parent stock by impassable barriers, produced as a result of geological and other changes, they will tend in the course of centuries to differ more and more from the parent stock. Glacial conditions which obtained in the Himalayas during the Ice Age are believed to have driven the Thar with other animals to colonise the Indian Peninsula, which is assumed to have enjoyed a more temperate climate during this epoch. The return of tropical con-

Assam : Dense evergreen forest.

Photos by C. McCann.

Assam : Interior of dense evergreen forest.

ditions in India is believed to have resulted in the extermination of the Thar in the Peninsular Region. But those which were able to obtain a refuge in the temperate climate of the higher altitudes of the Nilgiris and Annamallai Hill ranges survived. Isolation from the parent Himalayan stock, different conditions of life, produced in the course of centuries those differences in colouring and texture of coat, shape of horn and other characters which now distinguish the Nilgiri from the Himalayan Thar. In other words, a new and distinct species was evolved. But if no impassable barriers are created, the new varieties evolved in different connected areas remain more or less alike. There is interbreeding and consequently an intergradation of characters between these varied geographical races linking them with the parent form. Thus, among many widespread species of animals, we find more or less easily distinguishable geographical races, evolved as a result of the different conditions under which they live in different areas of their range. In the case of the Gaur or Indian Bison, which extends from India through Burma and the Malay countries, there are well marked differences in the shape of the skull which enable us to differentiate between the Indian Gaur and the gaur living in the forests of the Malay Peninsula. While the Gaur of Burma and Assam intergrade between these two extreme types.

In the past naturalists were content to classify animals in accordance with the salient characters or marked differences between species. In recent years it has been recognised that it is not only necessary to classify species but it is equally or more important to systematically record geographical variations where they exist in a species. This data, when sufficiently multiplied, will in future furnish information for the investigation of problems connected with the variation and distribution of species. Therefore, in more recent publications dealing with Indian animal life, we find due attention paid to the description of geographical races wherever these occur.

It will also be seen that a knowledge of animal life gives us a better knowledge of ancient geography. It reveals changes which have taken place in the distribution of land and water and shows how the present distribution of land animals has been brought about. We have seen also some of the factors which have influenced this distribution or produced changes in or the extermination of numerous forms. In our day, the agency which accelerates these changes is Man. In India, irrigation by human agency in the desert tracts of the Punjab and Sind has resulted in the conversion of vast tracts of desert land into fertile country. This is bringing about a change in the character of the animal life of these areas. Desert species are retreating from them. They are being replaced by forms more adapted to the changed conditions. Again, Man sweeps away forests, dams rivers and wipes out of existence races of animals which are the culmination of centuries of evolution. While Man is a destructive agent, he can also become a preserver and protect wild creatures from the destructive effects of his own handiwork. The need for saving the wild creatures of this world from annihilation is recognised in most countries of the world.

Various factors, as a result of human activity, are threatening the wild creatures of India with extermination. There is, as we have seen, great need in this country for adequate measures to preserve wild life from the destruction which threatens it.

The pages which follow contain illustrations and brief descriptions of the Mammals of the Indian Empire. They are based mainly on the observations of sportsmen and Naturalists who have contributed to the pages of the *Journal* of this Society during the past 50 years, whose writings have added so much to the sum of knowledge of the Natural History of the Indian Empire.

Among other books referred to are:

Dunbar Brander, A. A. 'Wild Animals in Central India'.
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Stewart, A. E. (Col.) 'Tiger and Other Game'.
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Champion, F. W. (I.F.S.) 'With a Camera in Tigerland'.
,, ,, ,, 'Sunlight and Shadow in the Indian Jungle'.
Lydekker, R. 'The Great and Small Game of India'.
,, ,, 'Catalogue of Ungulate Mammals (B.M.).'
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PART III.

Ungulates or Hoofed Animals.

The Ungulates or hoofed animals are included in four well defined Orders of Mammals:

(1) *Poboscidea*: Elephants.
(2) *Perissodactyla*: Rhinoceros, Tapir and Horses.
(3) *Artiodactyla*: Cattle etc., Deer, Camel, Hippopotamus and Pig.
(4) *Hyracoidea*: Coneys.

All of them are ground dwelling animals, all of them exclusively or mainly vegetarians in diet. With this common mode of life there is a common general plan in their structure. Unlike the clawed limbs of beasts of prey or the grasping hands of apes and monkeys, the feet of Ungulates are unsuited to any function beyond supporting and moving the body. Their main purpose is progression. They are built to withstand rough wear and to support and carry the body with speed over long distances.

With the exception of camels and the coneys, all Ungulates have the ends of their toes encased in a large horny hoof or protected by large hoof-like nails. A few among them are clumsy and slow moving creatures. The majority are slender-limbed and fleet of foot. In the open spaces in which many of them live, speed of movement is their main protection against numerous foes.

Hoofed animals walk on the very ends of their toes, not on the soles of their feet. By this means the full extent of the limb comes into action. Its stride is increased. Now, an animal moving on the tips of its toes presents the narrowest possible portion of its body to the resisting earth. Its body obtains sufficient support and leverage. Its feet can be disentangled from the ground with greater facility. It moves with greater speed because rapid mechanical progress over the unyielding surface of the ground depends largely on one factor. The points of a moving body which come in contact with the ground must be few in number and small in area. Resistance to movement is thereby decreased. When the area presented to the ground is increased, as in the case of an animal which walks on the soles of its feet, speed is diminished. Among hoofed animals the extent of the foot coming in contact with the ground is further limited by a reduction in the number of toes. With the exception of the elephant, no Ungulate has more than four functional toes. Some have three, the majority two, horses only one. Among these animals Nature's plan has been to lengthen and strengthen the bones of one or more of the original five toes and to dispense more or less completely with the others. Coupled with this perfecting of the foot as an organ for rapid movement there is a corresponding development in the length and system of articulation of the bonelets of the wrists and ankles. These developments have given greater firmness to the foot, making it less liable 'to give' under pressure and more suited to animals which run.

Speed and surety of movement has been reached not by the immediate invention of a new limb for this purpose. Nature has availed herself of existing structures—of the normal 5-toed foot. From this she has evolved the form of limb suited to the different needs of different hoofed animals. So far as can be judged, the various hoofed animals are derived from several stocks or primitive 5-clawed ancestors. In each of them the hoofs have been independently evolved in adaptation to similar habits of life. The varied modifications which have taken place in the limbs of Ungulates is seen by comparing modern types with those which flourished in the distant past. In the instance of the Horse, a complete transition is traced from a 5-toed ungulate of the Eocene or 'Dawn Age', walking partly on the soles of its feet, to a 4-toed, then a 3-toed horse and so finally to the modern horse which has a single toe on each foot and treads the earth on the very tip of these toes. The modern horse carries the rudimentary vestiges of the second and fourth toes in the shape of 'splint bones' on each side of the long bone of its fore and hind feet. Of its first and fifth toe no trace remains.

The gradual perfecting of the fore and hind limbs as running organs in hoofed animals has been put down to the changing conditions in their environments. It is believed to be due to changes in the earth's surface, to the raising of the level of the land and the consequent change in its climate and vegetation. These changes resulted in the conversion of marshy and forested tracts into upland, open, grass-covered plains, where the safety of these animals from numerous foes now depended on their capacity for rapid flight. The same reasons are believed to explain the modifications, which took place in the course of long ages, in the teeth of Ungulates. There has been a gradual change in the shape of the teeth. An early type, still seen in man and many mammals—a type suited to a mixed or even carnivorous diet has given place to teeth with flat grinding surfaces, complicated by folds and ridges of enamel. This is seen in the molar teeth of the majority of later Ungulates. In the horse for example, the grinding surface of the cheek teeth are made up of hard enamel ridges. These ridges are braced on either side by layers of softer dentine. The massive grinding organs are thus composed of substances of different density. An effective irregular grinding surface is always maintained by the persistence of the harder enamel and the wearing away of the softer dentine. The food of the Ungulates, consisting in most cases entirely of vegetable substances which require much mastication, is believed to be the inducing cause for the complex structure of the cheek teeth in the more specialised kinds. While their grinding teeth have undergone special development there is a decided tendency among the more specialised representatives of the Order to a reduction either in the size or in the number of the front teeth. The canine teeth are frequently small or absent; while the incisor teeth in the upper jaw and more rarely both the incisors and canines in the upper and lower jaws may be wanting. All the earlier Ungulates and the modern pigs have however well-developed tusks as well as the full number of front teeth.

ARTIODACTYLA OR EVEN-TOED UNGULATES.

Ungulates are divided into four Orders in accordance with certain common structural characters which the members of each of these groups exhibit. Three of these Orders are represented in the Indian Empire. The first comprises the *Artiodactyla* or even-toed Ungulates, Indian representatives of which are oxen, sheep, goat, antelope, deer and pig. These animals differ from other Ungulates in a number of characters. The most important is the arrangement of the toes. It has been indicated that the feet of the majority of Ungulates show a reduction in the number of toes and that this reduction has been effected in different ways. The Artiodactyla always possess either two or four toes, hence their name even-toed. In all of them the first toe is absent. The second and fifth toes are either wanting or reduced in size. They form the 'petty-toes' of cattle and pigs, which are either rudimentary, or do not touch the ground when walking. The third and fourth toes are large and equal in size. They are perfectly symmetrical. Together they support the full weight body. The centre line of the foot passes between them. The two hoofs which encase these toes present a flat surface to each other, and appear like a single large hoof cleft in two; hence the name cloven-hoofed, applied to these animals. This characteristic alone is sufficient to distinguish all the members of this group.

Artiodactyla which are extraordinarily numerous both in genera, species and individuals are divided into four main groups or sections, namely:—

(1) *Pecora*, Typical ruminants—Oxen, Sheep, Goat, Antelope, Giraffe and Deer;
(2) *Tragulina* or Chevrotain;
(3) *Tylopoda* or Camel and Llama;
(4) *Suina* or Pig, Peccaries and Hippopotamus.

PECORA.

Oxen, sheep, antelope and deer are classed as typical ruminants. They are believed to be of comparatively recent evolution. Descendants of primitive Artiodactyles mainly inhabiting the old world, they first appeared about the middle of the Tertiary Era. The centre from which they spread over the earth is apparently northern Asia. Thence they extended their territory into northern Europe on the one hand and north America on the other. Later they spread southwards to tropical countries. Ruminants are distinguished by several well-marked characters. Like all cloven-hoofed animals they have only two functional toes on each foot, but the long bones, immediately connected with these toes, are fused into a single long bone called the 'cannon bone'. The side toes are rudimentary or altogether wanting. The limbs and feet of ruminants are highly specialised both for speed and endurance. Their cloven hoofs give them a surer hold on rough and irregular ground and, as they expand when sinking and close on extrication, a firmer footing in marshy land. Their teeth are distinctive.

Ruminants, in general, have no cutting teeth in the upper jaw. Their place is taken by a soft pad. The tongue is used to draw the food into the mouth. To do this effectively its surface is covered with rough points all directed towards the throat just as in the tongue of a lion or a cat. The molar or cheek teeth have long crowns capped with crescent shaped tubercles, which with wear grind down into crescentic patterns.

The name 'ruminant' describes their well-known habit of ruminating or 'chewing the cud'.

There is considerable advantage in this habit to these bulky though timid animals. They require large quantities of a particular type of food which must be thoroughly chewed before its nutrition becomes available. Through the process of rumination large quantities of food can be eaten rapidly. The necessarily longer process of chewing it can be continued when returning from the feeding grounds or during rest, or put off till a place of safety is reached. The complex stomach of the ruminant is specially designed to assist in this process. It is divided into four separate chambers. The first and largest—the paunch, serves to contain the hastily swallowed food. Here it undergoes a softening process and is returned in small quantities to the mouth to be thoroughly chewed in that familiar slow and deliberate manner. As each mouthful is reduced to pulp it is swallowed and immediately replaced by another. The pulped food now enters the second division of the stomach—the *reticulum* or honey-comb bag, so-called because its walls resemble a honeycomb. In the honeycomb bag the food is pressed and shaped and sent up the gullet again. It then passes into the third and fourth divisions of the stomach. The actual work of digestion takes place in the last chamber.

Typical Ruminants found within Indian limits are grouped in two families:

(1) The *Bovidae* or hollow-horned Ruminants which include oxen, sheep, goat and goat-antelope, antelope and gazelle,

(2) The *Cervidae* which includes the deer.

BOVIDAE OR HOLLOW-HORNED RUMINANTS.

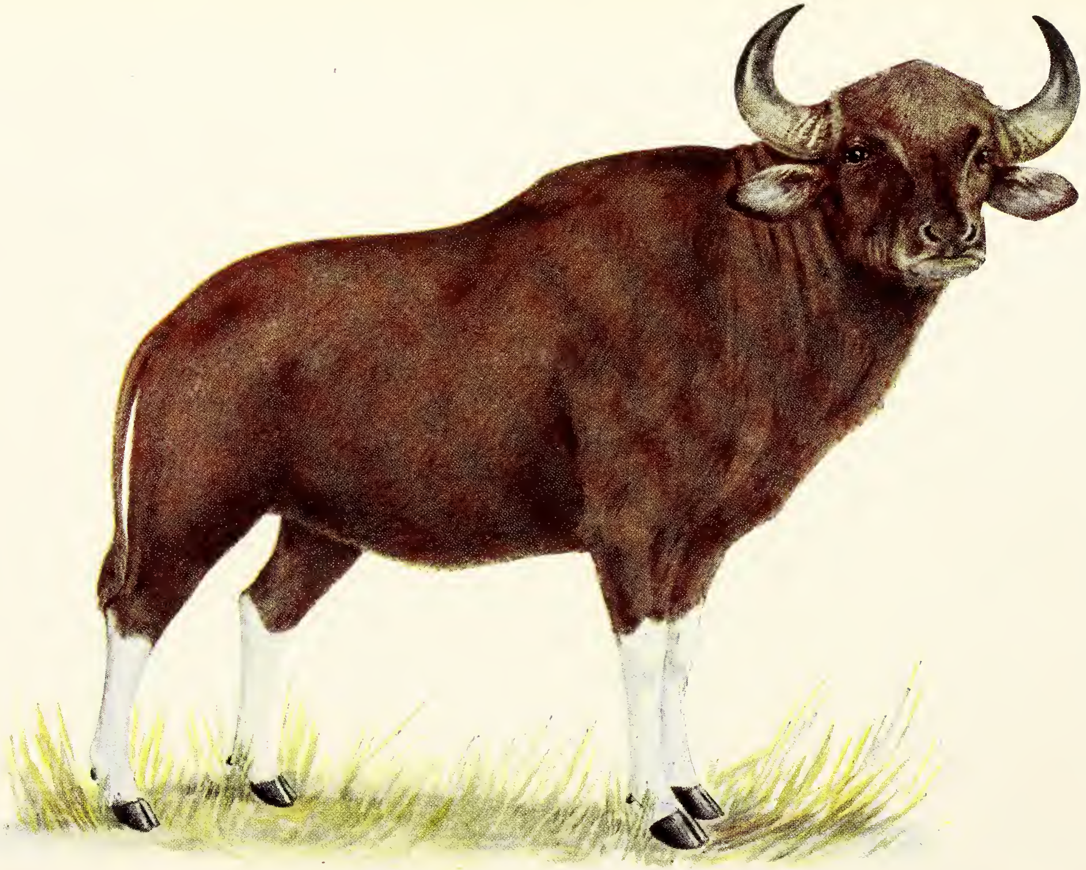
The horns of oxen, sheep, goat, antelope and gazelle consist of two parts—a core of bone and an outer cap of tough, true, horn. In the majority of genera both the core and its horny cover are permanent during the life time of the animal. In the deer the same core of bone is present and forms the substance of the antlers. As with the hollow-horned ruminants the horns of deer are covered with a skin pad. This covering—the velvet lasts only for a certain period and is then rubbed off by the exertions of the animal, leaving behind the bony core which is popularly termed the horn. Stags however periodically shed this bony part of the horn, a state of affairs which has no parallel among hollow-horned ruminants.

The Bovidae or hollow-horned ruminants are a very extensive family, containing all the cattle, goats, sheep and the antelopes. They are distributed throughout Europe, Asia and North America. Eleven genera are found within Indian limits. These are included in 5 sub-families: (1) *Bovinae*, Domestic and Wild Cattle; (2) *Caprinae*, Sheep and Goats; (3) *Rupicaprinae*, Serow, Goral and Takin; (4) *Tragelaphinae*, Nilghai; (5) *Antilopinae*, Antelopes and Gazelle.

Sub-Family 1. *Bovinae: Gaur, Banting Yak and Buffalo.*

The Bovines are as a rule large and massively built animals. The neck is short and thick, the tail always long and tufted at the tip. The muzzle broad, naked and moist.

In the Indo-Malayan region there are 4 species belonging to this group, i.e. the Gaur (*Bibos gaurus*), the Banteng (*Bibos banteng* , the Yak (*Poephagus grunniens*) and the Indian Buffalo (*Bubalus bubalis*).



The Indian Bison or Gaur (*Bibos gaurus*, H. Smith).

THE GAUR (*BIBOS GAURUS*, H. SMITH).

The Gaur, one of the noblest animals of the Indian forest, is apparently the largest of existing Bovines. A striking character in the build of a Gaur is the muscular ridge upon its shoulders which slopes down to the middle of the back where it ends in an abrupt dip. With its huge head, the muscular ridge crowning its deep body and its sturdy limbs the Gaur is the embodiment of vigour and strength. A bull may stand 6 ft. 4 ins. at the shoulder. The average height is between 5 ft. 8 ins. and 5 ft. 10 ins. Cows are about 4 ins. shorter. Gaur appear to attain their finest development in the South Indian hill ranges and in the forests of Burma and Assam.

The horns are large and massive, considerably flattened and corrugated at the base, rounded, smooth and turning inwards at the tips. Cows have smaller and less sturdy horns. They are rounder and have a narrower sweep. In bulls, a good average horn is 27 ins., anything over 30 ins., is a fine head. The spread of the horns taken together with the girth is the real test of a good head.

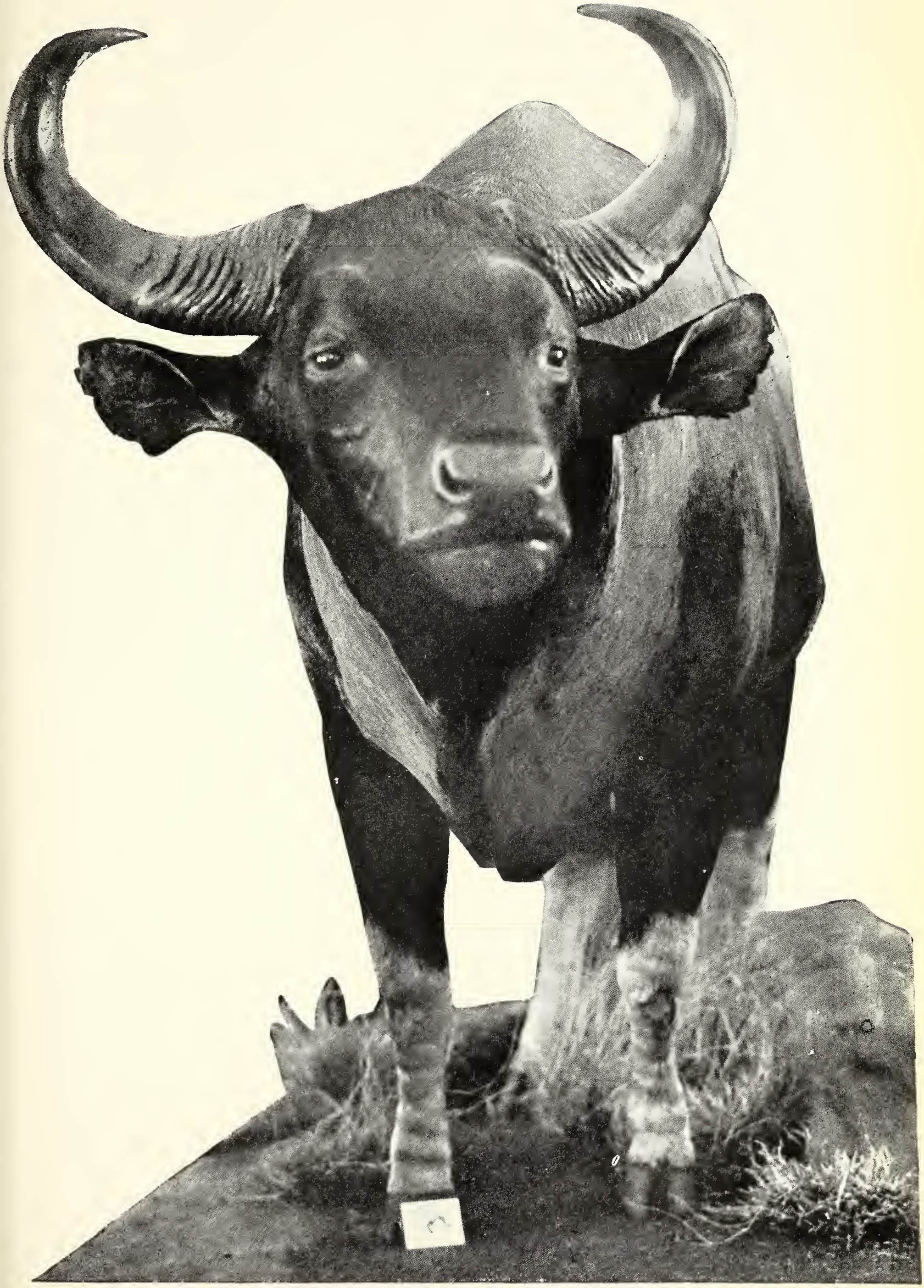
The newly born Gaur is a light golden yellow which soon changes to fawn, then to light brown and so to coffee brown or reddish brown—the colour of young bulls and cows. Old bulls are jet black—their bodies almost hairless. In the dim light of the forest an old cow may be mistaken for a bull; it looks almost as black. The dark colouring of the body is set off by an ashy coloured forehead and yellowish or white stockinged feet. Though often described as pale blue, the eye of the Gaur is brown. It is true that when the light falls on it at certain angles, the eyes are a beautiful blue. This is caused by the *Tapetum lucidium*, the membrane behind the eye-ball which is of a lovely peacock blue.

Though found in low forest in the neighbourhood of hills, Gaur are essentially mountain animals. They usually live in small herds, believed to comprise single families which, in quest of pasturage or from other causes, may unite to form larger herds. They graze at dusk or in the early morning and retire during the hotter hours of the day to the seclusion of the jungle. Except when breeding, they are peaceful animals and bulls of all sizes herd in perfect amity with the cows. A young bull, when mature, generally lives away from the herd, alone or in company with other bulls. These usually keep in the vicinity of the main herd, but wander more in quest of grazing. In the mating season, the younger bulls are driven away by the master bull who obtains possession of his cows by right of conquest. The herd bull generally returns to his accustomed hermit existence till the urge to mate is on him when he will again seek the cows and dispute with other aspirants the right of lordship. Really old beasts past the urge or capacity to mate lead truly solitary lives.

Gaur are by nature timid animals usually shunning the neighbourhood of man. They have a keen scent but comparatively poor eyesight and hearing.

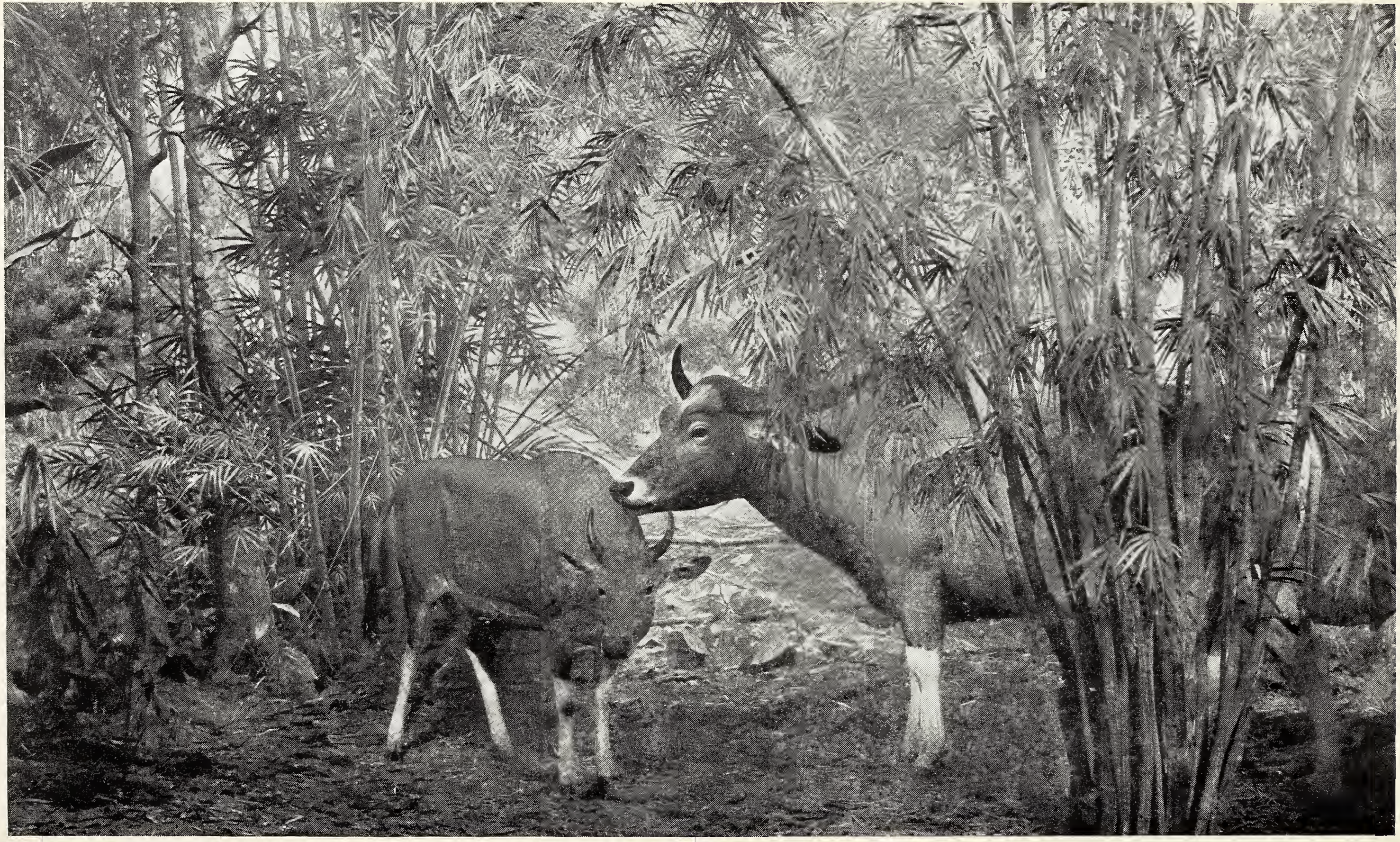
Gaur range through the larger hill forests of India, Burma and the Malay Peninsula. The eastern limits of their territory is imperfectly known. The Gaur of the Malay forests is regarded as a distinct race. It is distinguished from Gaur inhabiting the Indian Peninsula by the shape of its forehead which is less concave, the great arch of bone between the horns being less prominent or practically absent.

The Gyal or Mythun (*Bibos frontalis*) is the product of interbreeding between a bull Gaur and domestic cattle. At the fourth generation the true stage of mythun is reached—an animal of lesser stature than the Gaur, shorter limbs and usually a well developed dewlap. The arched ridge between the horns and the concave forehead of the Gaur disappear. In the Mythun the vertex of the skull between the horns is straightened and the forehead flat. The horns show a slight upward curve without the terminal inward sweep. If breeding with domestic cattle is continued, the high dorsal crest is reduced to a mere hairy thickening on the back, the horns become more cow-like and the domestic cows' varied colouring begins to appear. Mythun are found in the mountainous tracts from North Cachar; through Manipur, to the Lushai and Chin Hills. They are the peculiar and characteristic possession of the hill tribes inhabiting this region.



Prince of Wales' Museum, Bombay.

The Gaur or Indian Bison (*Bibos gaurus*, H. Smith).



By courtesy of The Amer. Mus. Nat. Hist., New York.

Banting or Tsaine (*Bibos banteng birmanicus*. Lyd.).

THE BANTING OR TSAINE (*BIBOS BANTENG BIRMANICUS* LYD.).

The Banting, the Wild Ox of Burma, is a smaller animal than the Gaur, nevertheless he is massively built and stands quite 5 ft. 6 ins. at the shoulder or even higher. He is longer in the leg and the dorsal ridge is less prominent but he has the same sturdiness of limb and displays the same agility and vigour of movement as his relative.

The high concave forehead and 'roman' nose of the Gaur is wanting in the Banting. The horns are connected by a hairless mass of horny substance as hard as the skull beneath. The horns grow differently. They stand out at right angles to the skull and then turn upwards and inwards somewhat abruptly. They have the same rugged corrugations in front as in the horns of a Gaur, but are less massive. The colouring is perhaps lighter. Good average horns measure about 24 ins. in length with a girth of 14 ins. and a spread of 25 to 30 ins. Anything over 25 may be regarded as a good head. Young bulls and cows have cylindrical horns, those of cows grow almost straight upwards, are smooth throughout with but little girth.

Cows and young bulls are a bright chestnut with a white face, white stockings and a distinctive white patch on the buttocks. Young bulls sometimes show white spots on the flanks which in time merge and turn a dirty grey. Older animals are described as being yellowish brown, sometimes turning into a soiled grey on the sides. Old bulls usually have the face down to the muzzle dirty white, almost approaching grey. The coat may be entirely grey or khaki, sometimes dark chocolate brown, more rarely, quite black like the Javanese Banting. Ordinarily, in Burma, the older the bull the lighter in colour it becomes. Burmese domestic cattle tend to resemble Banting, in colour they have white patches on the buttocks and white stockings. Banting occasionally consort with domestic cattle.

The Banting, unlike the Gaur, prefers flat or undulating country. In hill country they do not ascend to great elevations and keep to the lower slopes. During the early rains they enter bamboo jungles to browse on the young shoots and during the hot weather may seek the shade of heavy jungle and cane brakes. In general they prefer lighter kinds of forests. They wander about visiting different grounds at different seasons of the year, their migrations being influenced by the pasturage.

The herding and mating habits of the Banting are in no way different to the Gaur. Master bulls take possession of the cows during the mating season and otherwise lead a solitary existence.

The Banting is a shyer and much warier animal than the Gaur, the sense of scent, sight and hearing are acutely developed.

The range of the Banting includes Burma, Siam, the Malay Peninsula, Borneo and Java. About 5 races have been described within this area.

THE YAK (*POEPHAGUS GRUNNIENS*).

An adult bull Yak stands about 5 ft. 6 ins. at the shoulder and may reach over 6 ft. It is a massively built animal with a drooping head, high humped shoulders a straight back, and short sturdy limbs.

Shaggy fringes of coarse hair hang from its flanks, cover chest, shoulders, thighs, the lower half of the tail and form a bushy tuft between its horns and a great mane upon its neck. Its great bulk, wild unkempt appearance and glaring eyes give the Yak a formidable aspect. Conspicuous and distinctive as is this clothing of long hairs, the Yak receives additional warmth through the rigorous winters from a dense under-coat of soft closely matted hair. In the spring the under fur is shed; it comes away in great masses and, though completely separated from the skin, adheres in untidy scattered patches to his hairy body. A baby Yak differs markedly from its parents in the absence of the long hair fringes, which are not noticeable in the calves until the second or third month.

The horns of a Yak are more or less rounded and quite smooth. In old bulls, the horns may be slightly compressed at the base but are never flat or corrugated as in the Gaur or Banting.

The colour of a wild Yak is a uniform blackish brown with a little white about the muzzle. Domestic Yaks of mixed breed frequently display a tendency to piebald colouring.

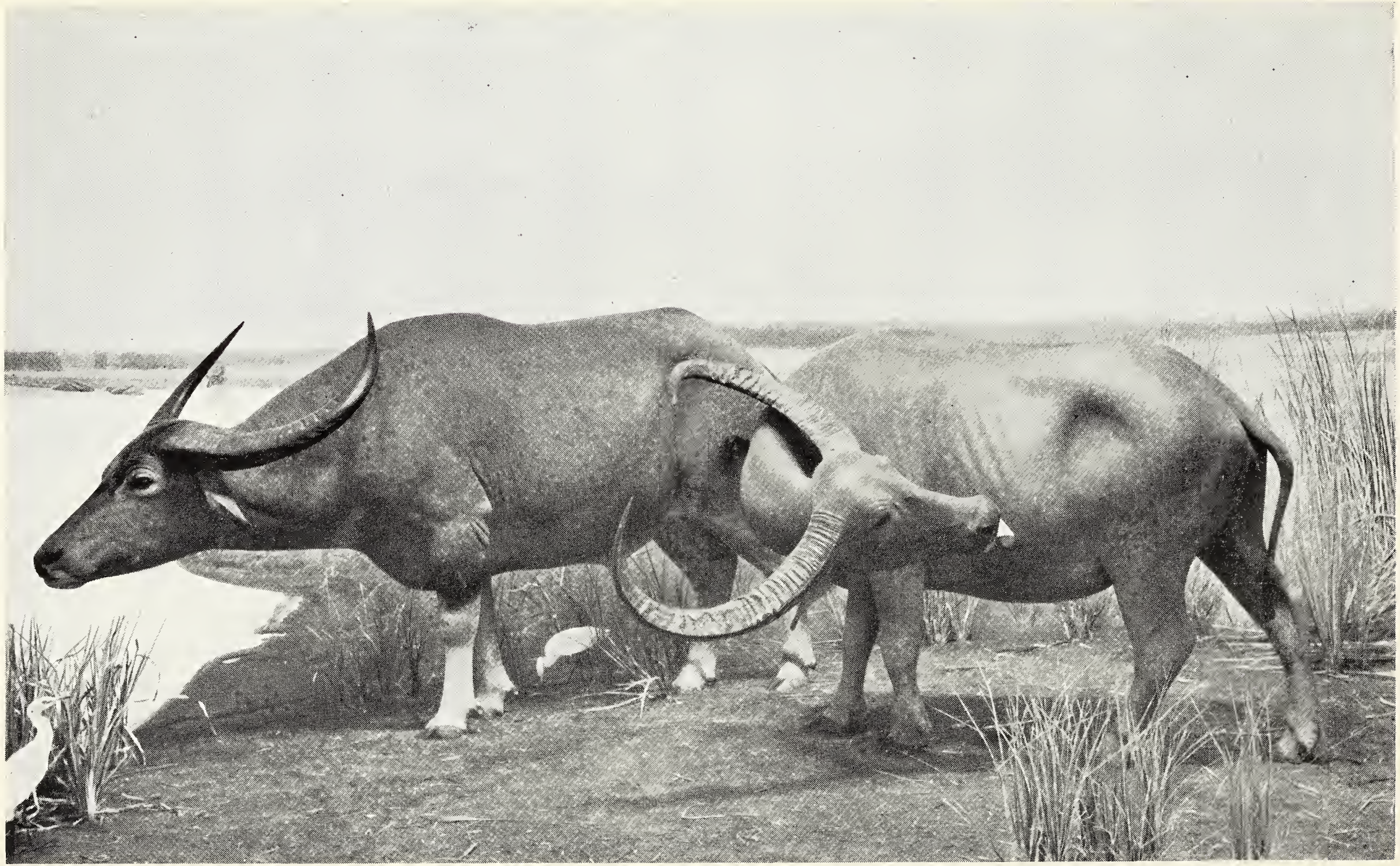
An inhabitant of the coldest, wildest and most desolate mountains of the Tibetan Plateau, where both arctic and desert conditions prevail, the Yak lives in a continuous struggle with the fiercest elements of Nature.

They are seldom found in very large herds, except in the spring when the cows and calves congregate on the grazing grounds. Bulls are generally solitary or found in small parties of three or four, except in the rutting season in late autumn and winter when the master bull is usually accompanied by 4 or 5 cows. Wild Yak cross freely with Ladaki cattle.

Yak feed in the mornings and evenings on the wiry grasses which grow in the valleys and have been noticed eating quantities of salt earth which in some parts cover the ground with a white crust. They retire to the steep barren hillsides to rest and ascend to great elevations.

Yak display an amazing agility in climbing; a herd is said to travel in single file, each member carefully placing its feet in the imprints left by the hoofs of the one preceding it.

The Yak is restricted to Tibet and the adjacent districts of China.



By courtesy of The Field Museum, Chicago

The Wild Buffalo (*Bubalus bubalis*, L.).

THE INDIAN WILD BUFFALO OR ARNA (*BUBALUS BUBALIS*, L.).

Wild Buffaloes are much larger than the tame buffalo and generally more hairy. A bull from the Godaveri district scaled 2,001 lbs. A large bull stands 5 ft. 6 ins. at the shoulder and may even reach 6 ft. Though it has a finer carriage, the Wild Buffalo differs little from the tame. Domestication has scarcely changed it.

There are said to be two varieties of Indian Wild Buffalo—one with straight horns turned up at the tips; the other with horns which curve upwards to form a semicircle. Both types may be found together in the same herd and there is much inter-grading between the two forms. The horns are flat and triangular in section; those of cows are less massive and vary less in shape. Occasionally, a cow with a fine length of horn is seen. The largest known horn—a cow's—is 77 3/8 ins. in length. Giants of this size must be exceptional.

Like the tame, the Wild Buffalo is a slaty black animal. The legs are a dirty white beginning just above hock and the knee—in this they resemble Gaur. The new born calf is light coloured—almost yellow. Some domestic buffaloes have the same white legs and some show a white patch between the horns.

Wild Buffaloes move about in small herds. In their social life they follow the custom of their tribe. During the rut, the younger bulls are temporarily driven out, the master bull taking possession of the cows.

The younger bulls or a solitary old bull, powerless to obtain lordship over a herd, frequently mix and breed with tame buffaloes which are driven into the forests to graze.

The rut is said to commence at the end of the rains and the young are born mainly between March and May.

Wild Buffaloes live almost entirely upon grass. Grass lands—not always marsh—interspersed with nullahs provide the conditions they prefer. They have no fear of approaching villages, come to village tanks to drink and, during the rains, frequently enter cultivation.

In India, the Wild Buffalo is found in the grass jungles of the Terai, in the plains of the Ganges and Brahmaputra in Assam, in Midnapore and Orissa and in the south-eastern portion of the Central Provinces. The numerous herds of Wild Buffalo, once seen in the C. P., are now a mere tradition. Association with domestic cattle places the Wild Buffaloes in constant danger to disease to which it is very susceptible. This is one of the animals which requires strict protection if it is not to be exterminated. An allied race of our Wild Buffalo occurs in Borneo—it is smaller in build and carries smaller horns.

ii. Sub-Family II.: *Caprinae.*

Sheep and Goats.

Sheep and Goats form the second division of Bovines. The majority of species inhabit the Highlands of Central Asia. This is in marked contrast to Africa where only 3 members of the group are present and these restricted to the northern parts of the Continent. Three species of wild sheep and three species of wild goats are found within our frontiers. They inhabit the Himalayas and the trans-Himalayan countries, the hill ranges of the Punjab, Sind and Baluchistan. The Himalayan and the Nilgiri Thar are also included in the present group.

Sheep differ in some ways from Goats. Their horns curl forwards by the sides of the face or outwards in an open spiral. The horns of Goats are situated close together, immediately above the eyes and spring upwards in the same plane as the forehead. They are either spirally twisted or scimitar shaped. Sheep usually have shorter tails, the males do not grow a beard nor have they the strong unpleasant odour of goats.

Most sheep have a small gland below the eye which lies in a corresponding depression in the skull and a small gland in each foot between the hoofs. Goats have no face glands, no gland in the hind feet and in some cases none in the fore feet. The purpose of these foot glands in Ungulates appears to be the lubrication or greasing of the hoofs and the prevention of injury from friction. Domestic goats have glands in the fore but not in the hind feet. A hind quarter of a goat with hoofs attached therefore can be at once distinguished from a sheep's by the absence of the hollow feet-pits—a point of some domestic interest when an attempt is made to substitute goat's mutton for sheep's.

Some wild goats, like the Himalayan Ibex, are hunted for their dense soft under-fur. It is used as lining for shawls, for stockings and gloves and is woven into fine cloth called *tasi*. No wool is so rich, so soft and so full. The hair is manufactured into coarse blanketing for tents and twisted into ropes. The skin of the Himalayan Ibex, when tanned, provides the best leather for the sock-like boot worn in Kashmir and the Pamirs.

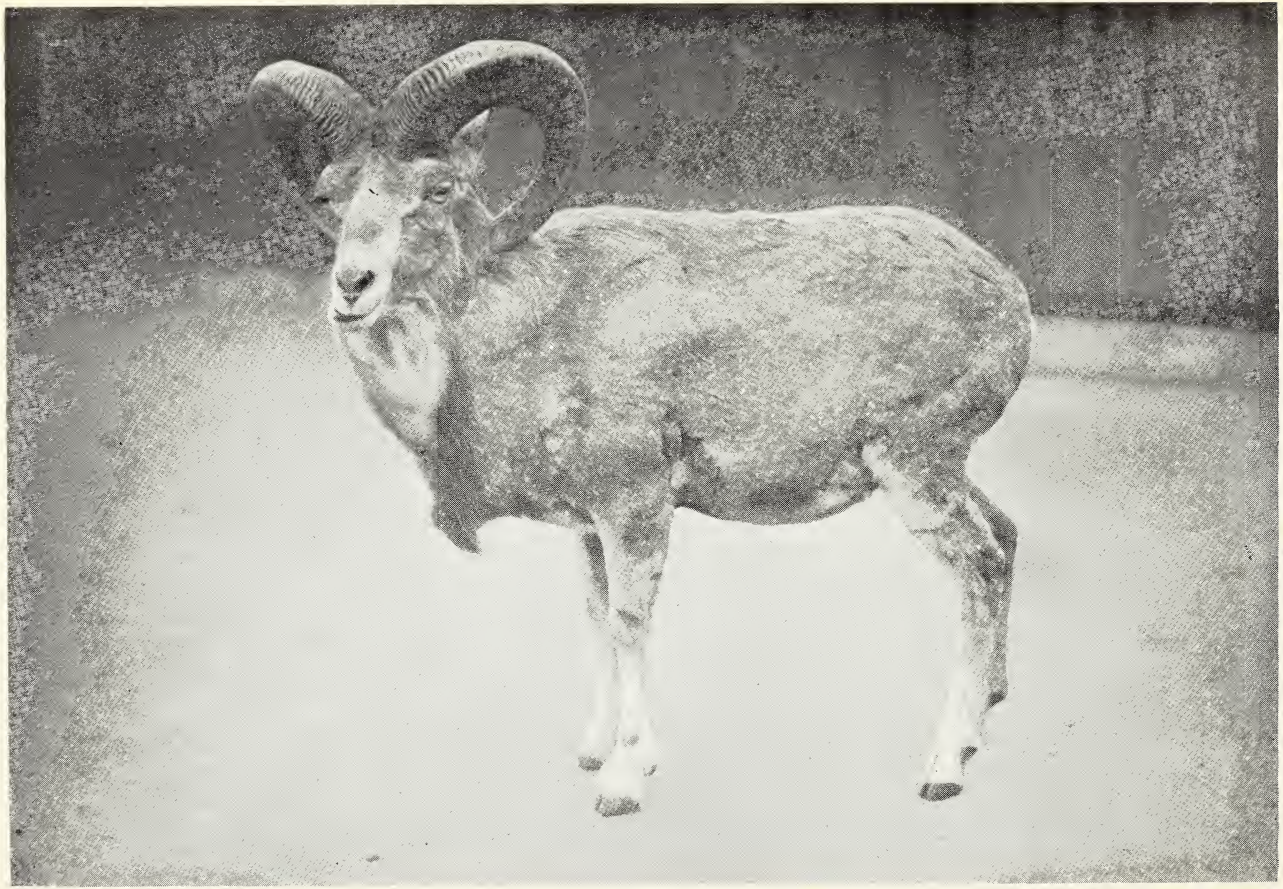


Photo by *W. S. Berridge.*

The Urial (*Ovis vignei*, Blyth).

THE SHAPU OR URIAL (*OVIS VIGNEI* BLYTH).

The Wild Sheep known as the *Shapu* in Ladak, the *Oorial* in the Punjab and the *Gad* in Baluchistan lives under widely differing conditions, in its extensive range. Three geographical races are distinguished by colour and size and the form of the horns. They are the Ladak Oorial (*Ovis vignei vignei*), the Afghan Oorial (*Ovis vignei cycloceros*) and the Punjab Oorial (*Ovis vignei punjabiensis*).

The Ladak Urial stands about 3 ft. or more at the shoulder. In summer its coat is rufous grey or fawn, in winter a mixture of grey and brown. The Punjab Urial is smaller and redder in colouring. The adult Urial ram wears a great black or grizzled ruff growing from either side of the chin and meeting and extending down his throat. In older rams the ruff is grey or white in front passing into black behind. In its sleeker summer coat much of the ruff is shed. It is best developed in the Punjab race. The horns are strongly wrinkled. They are set close together and curve round in a circular sweep. In the Ladak Urial the horns usually turn inwards at the tips, in the Afghan race they tend to turn outwards and form an open spiral, in the Salt Range, Punjab, they tend to form a circle. But there is much variation in horn curvature, these divergent types may be seen in the same herd, within the same area. The record horns of the three races are as follows:—Ladak Urial 39 ins.; Afghan 41½ ins.; Punjab 38¼ ins.

In Ladak, this sheep inhabits open valleys and hill sides; in Astor, the grassy mountain slopes at moderate elevations below forest. Its environment in the Punjab is rocky scrub covered hills, in Sind and Baluchistan it is found in the barren stony ranges.

Urial are sturdy active sheep ever wary and alert. As with most wild sheep, the older rams live apart from the ewes, except during the breeding season. In the Punjab hills, the rut occurs between October and November, and the lambs are born 5½ months later, in April and early in May. In Astor, lambing takes place in June. Urial cross freely with domestic sheep.

The Ladak Urial ranges from Astor to the Zaskhar range in Ladak and probably eastwards into Tibet. The Punjab race is found from Jhelum Salt Range northwards; the Afghan race is from Baluchistan and Afghanistan and is said to include the Urial inhabiting the Khirthar range and its lower spurs in Sind.

THE NYAN OR GREAT TIBETAN SHEEP (*OVIS AMMON HODGSONI* BLYTH).

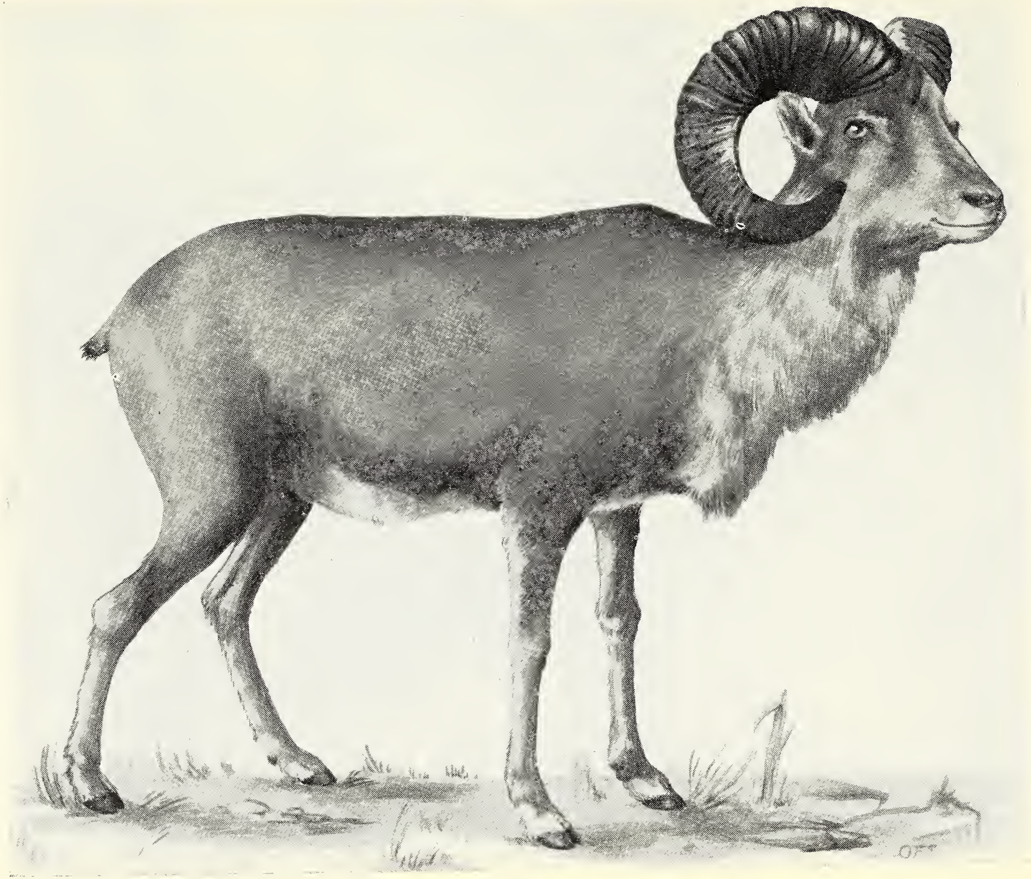
The Argali (*Ovis ammon*), the largest of all wild sheep, inhabits the Himalayas and the highlands of Central Asia. Over this extensive region this sheep varies in different areas in the form of its horns, colouring or size. Several more or less distinctive races are recognised. Two races of the Argali—the Nyan or Great Tibetan Sheep (*Ovis ammon hodgsoni*) and Marcopolo's Sheep (*Ovis ammon poli*) occur within our frontiers.

The Great Tibetan Sheep stands from 3½ to 4 ft. at the shoulder. Long in the leg, graceful and light—it suggests an antelope in build. Its massive wrinkled horns, 16 to 19 ins. in girth, curve in almost complete circle. The record, a picked-up head, measures 57 ins.

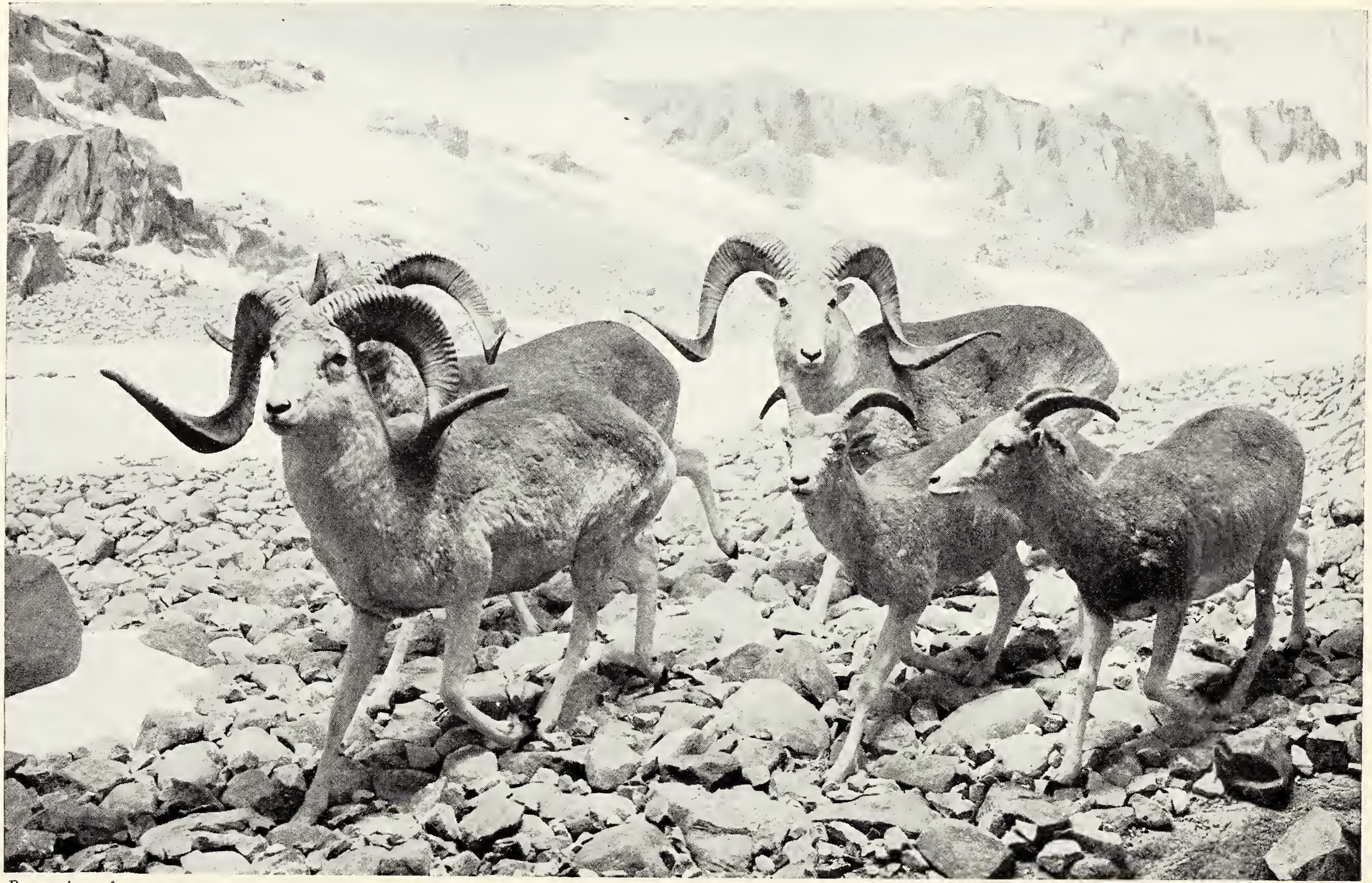
The ram is light brown with darker withers. His throat, rump, underparts and limbs are white. Adult rams have white heads and develop a white ruff about the neck much of which is shed with the winter coat.

The Tibetan Plateau, where Nyan live, presents a wilderness of desolate plains and low undulating sand hills, scorched in summer and swept by icy winds through the freezing winters. In this desert terrain the sheep are naturally migratory and wander to wherever food and water is to be got. In the spring, when the melting snows cause the scanty herbage to sprout, they frequent the borders of the snow line or enter the ravines, some of which hold trickling streams whose banks are covered with low bushes and herbage. They summer in the higher levels above 15,000 ft. and in winter descend to the shelter of the lower valleys. They feed early in the morning and again in the evening and climb some bare hillside to rest during the day. They avoid the damp snow and select some dry spot on the stony slope, kicking out with their feet a shallow 'form' in which to lie down. Their colouration is highly protective. It is difficult to discover them except in movement. When lying down they usually keep their heads erect but, when sleeping, lie with outstretched necks, the big rams resting their great curling horns on the ground.

In the spring, the sexes separate. Through the summer the older rams herd together in small parties and usually live apart from the ewes and yearlings. They rejoin them in the late autumn when the mating season begins. The young are born in May and early June, when the ewes seek the shelter of the more secluded valleys to lamb. This sheep was once plentiful in the country to the eastward of Chang-Chemo in Ladak and across the Tibetan border in the region lying to the north-east of the Pangkong Lake. They occasionally cross into Spiti, Nepal and Kumaon and are also found in the neighbourhood of the Tso Lhama Lake in the extreme north of Sikkim.



The Nyan or Great Tibetan Sheep (*Ovis ammon hodgsoni*, Blyth).



By courtesy of The Field Museum, Chicago.

Marco Polo's Sheep (*Ovis ammon poli*, Blyth).

MARCOPOLO'S SHEEP (*OVIS AMMON POLI* BLYTH).

Marcopolo's Sheep is a race of the Argali. It has less massive horns which form an open and extended spiral.

An adult ram is from 11 to 12 hands high at the shoulder and scales about 250 lbs. Like the Nyan, he is long legged and light in build. His magnificent horns, deeply wrinkled and the colour of old ivory, curve in a circle, then extend outwards in a bold sweep. The record pair is 75 ins. in length. The average length is about 52 ins. with a girth of 15 ins. at the base. In winter the adult ram has a creamy white head, legs and belly. His flanks are grey, merging into the darker brown of the back. The general colouring is that of the bare boulder strewn terrain in which this sheep lives. The colour makes the animal almost invisible, except in movement. Young lambs are uniform dark grey; yearlings a lighter mouse grey. The heavy winter coat is replaced about the end of May by the short paler summer pelage.

Rolling boulder strewn plateaux, cut up by broad stony nullahs, set against a sky line of snow-capped mountains—this is the dead and desert region in which *Ovis poli* live. In the spring the little patches of grass along the snow line and the nullahs, where a small lake or winding stream produces herbage, form their habitual resorts. Their food is then limited to the bunches of wiry grass and later to a species of wild onion which springs up in the sandy tracts. After a hard winter, conditions are most arduous and many die of starvation. In the summer, when there is a fair growth of grass over the Pamirs, the veteran males ascend into the higher and more remote nullahs. They feed morning and evening and go up some bare hillside to rest during the day; always moving in single file, the big ones leading. Excellent of sight and wonderfully keen in scent, when alarmed, they stand stock still or crowd together stamping the ground with their forefeet, even advancing nearer. All at once one bounds away, the herd follows heads held high, galloping with long easy strides but, intensely curious, they go a short distance, then turn and stop to see what disturbed them.

In their breeding habits differ in no way from the Tibetan Nyan. The rams fight as sheep do—a frontal attack with lowered head, the horns meeting in a clash which can be heard a long way off, or they charge alongside to strike sideways at the ribs and flanks.

Within Indian limits, *Ovis poli* are found only in Hunza. The Mir of Hunza has given them for some years strict protection in his territory. They exist in more or less reduced numbers in most of the side valleys of the Tagdumbash Pamirs. In the Russian Pamirs they still seem to be plentiful.

BHARAL (*PSEUDOIS NAHOOR* HODGSON).

In structure and habits the Bharal holds a place intermediate between the sheep and goats. Its horns are rounded and smooth, and curve backwards over the neck. This sheep has no face glands. Their position is however marked by a small bare patch of skin. In these characters the Bharal approaches the goats. But a Bharal ram is not bearded nor has he the unpleasant 'goaty' odour. Again, Bharal may have glands between the hoofs in all four feet; in goats these are always absent in the hind limbs.

A Bharal ram is about 3 ft. at the shoulder, stout and powerfully built. It scales, according to the time of the year, from 120 to 150 lbs. Its coat is dense. The general colour of the head and upper parts is brownish grey, suffused with slaty blue, browner in summer and more distinctly slaty grey in winter. The colour in any season blends perfectly with the blue shale and rock of the open hillsides where Bharal live. The face and chest in old rams is black. A black stripe runs along the middle of each flank and down the front of the legs. All these black markings are absent in ewes. The horns are smooth and marked with fine striations—lines of growth. They curve outwards and downwards and, in well grown rams, curl backwards at the tips. The record head from near Gyantse, Tibet, is 33¼ ins.; 23 ins. may be described as a good head.

To find Bharal one must seek the higher altitudes, neighbouring on 16,000 ft. in summer, and rarely below 12,000 in the winter. In the main Himalayan Range they are found on the levels between the tree and snow line where there is rich and abundant grass. In the Zaskar and Ladak ranges the slopes above tree line are bare and they find their food in the occasional patches of coarse grass, moss and dwarf shrubs. Bharal climb like goats and take to the most difficult and inaccessible places when disturbed but never enter forest or scrub. They live in large flocks, numbering as many as 200. These mixed flocks of rams and ewes may contain well grown males but the mature rams keep somewhat to themselves. In spring and summer the really old rams seek the higher levels and rejoin the females and younger males in September.

Unlike the Urial the Bharal will not cross with tame sheep nor is it as easy to tame.

Though typically a Tibetan animal, the Bharal is also found in Sikkim, Ladak and Nepal.

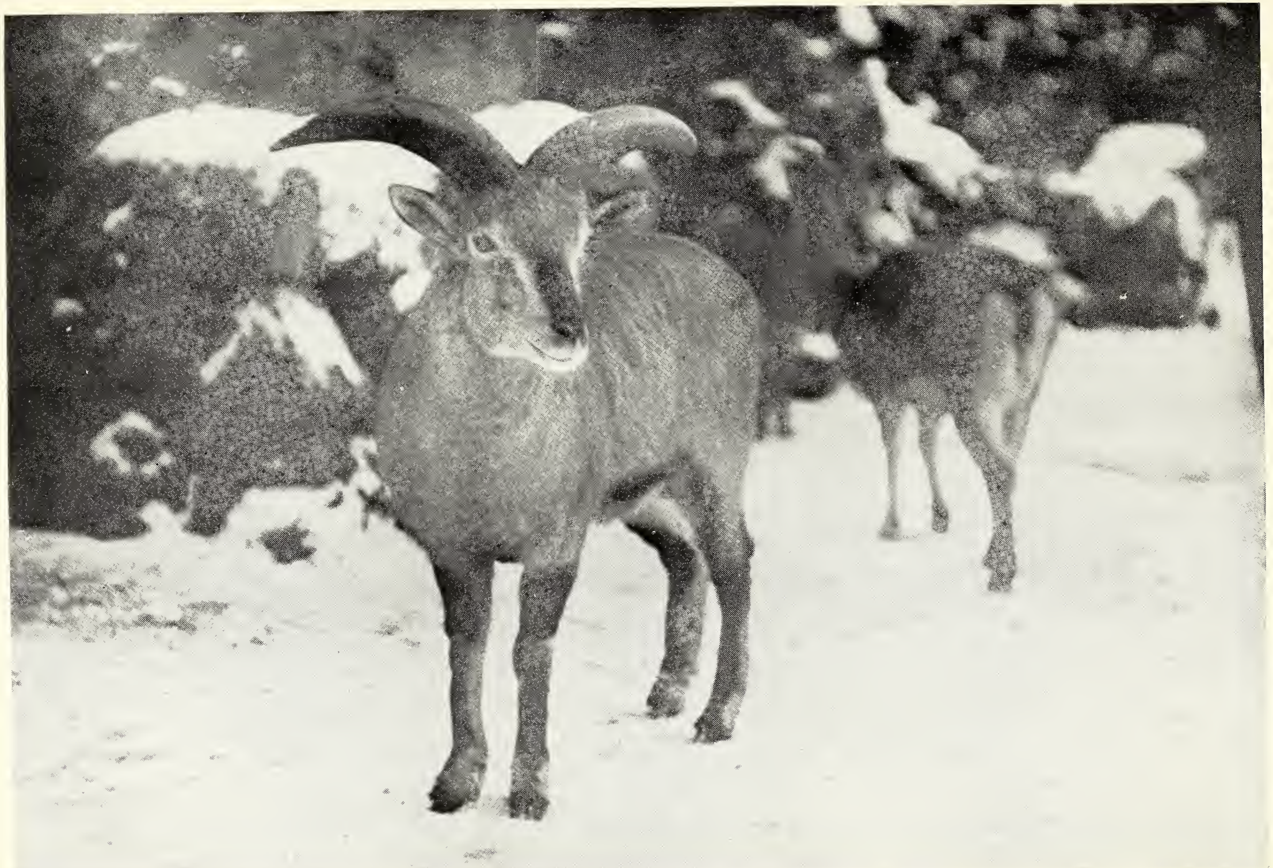
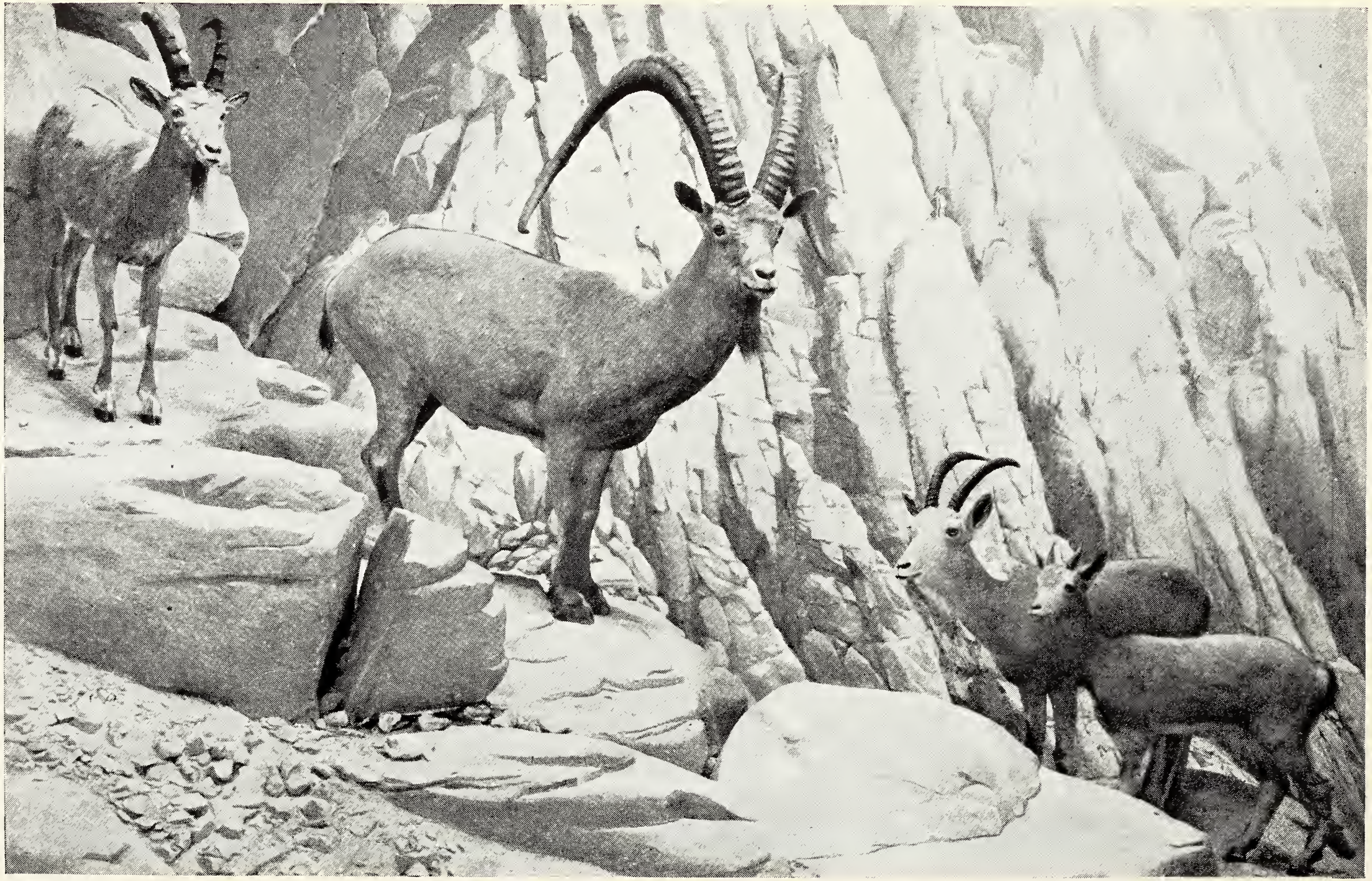


Photo by *W. S. Berridge.*

The Bharal or Blue Wild Sheep *Pseudois nahoor,* Hodgs).



By courtesy of *The Field Museum, Chicago.*

The Tien Shan Ibex (*Capra sibirica almasyi*, Lorenz).

THE ASIATIC IBEX (*CAPRA SIBRICA* MEY.).

The Genus Capra (Goats) is represented in our area by three species:—The Asiatic Ibex (*Capra sibrica*), the Sind Wild Goat (*Capra hircus blythi*) and the Markhor (*Capra falconeri*).

There are various geographical races of the Asiatic Ibex—a species closely related to the Alpine Ibex (*Capra ibex*) of the Swiss Alps. The Asiatic animal is considerably larger in size; standing as high as 42 inches at the shoulder. It is a sturdy, thick set goat, with a great beard and a coat of coarse brittle hairs. In winter, a dense under-fur of wool helps it to withstand the intense cold of its native mountains. The colour is variable. In general, the winter coat is yellowish white more or less tinged with brown and grey. In summer, the general hue is dark brown with irregular white patches. A male in good condition, weighs slightly over 200 lbs. The female is yellowish brown and insignificant to look at. The great scimitar shaped horns of the buck are flat and bossed with bold ridges in front. They are usually larger in the Tian Shan Race (*Capra sibrica almasyi*). The record length being 58 ins. The Kashmir Ibex is known as *Capra sibrica skyn*. It is a paler, brown-coloured animal with rather shorter horns than the Tian Shan Ibex. The record head from Gilgit is 55 ins. The various races of Asiatic Ibex, said to be distinguishable by the form of the horns, and differences in general colouring, cannot be satisfactorily separated by these characters which vary considerably in the same areas.

Ibex live in flocks numbering from a dozen to 40 or 50, though much larger herds have been seen. Their favourite grounds lie in the higher elevations well above the tree line. Here, on the precipitous sides of some cliff or nullah, patches of grass and small plants give them grazing. They feed early in the mornings and evenings and then climb up higher into the forbidding shelter of rock and snow to rest. Sentinels, usually an old ewe or ewes, are posted on some projecting rock or commanding point. Ever vigilant, they utter the shrill whistle of alarm which sends the flock dashing down and then upwards again, away to shelter among the precipitous steeps.

In spring and early summer, the old males are usually with or near the females and young but later in the summer the patriarchs retire to the more inaccessible mountains. They rejoin the main herds about October. The young are born in May and early June. The Himalayan Ibex inhabits the Western Himalayas on both sides of the main Himalayan Range and the mountain ranges which lie beyond in Kashmir and Baltistan. Its eastern limits are set by the upper reaches of the Sutlej River, east of which it does not occur.

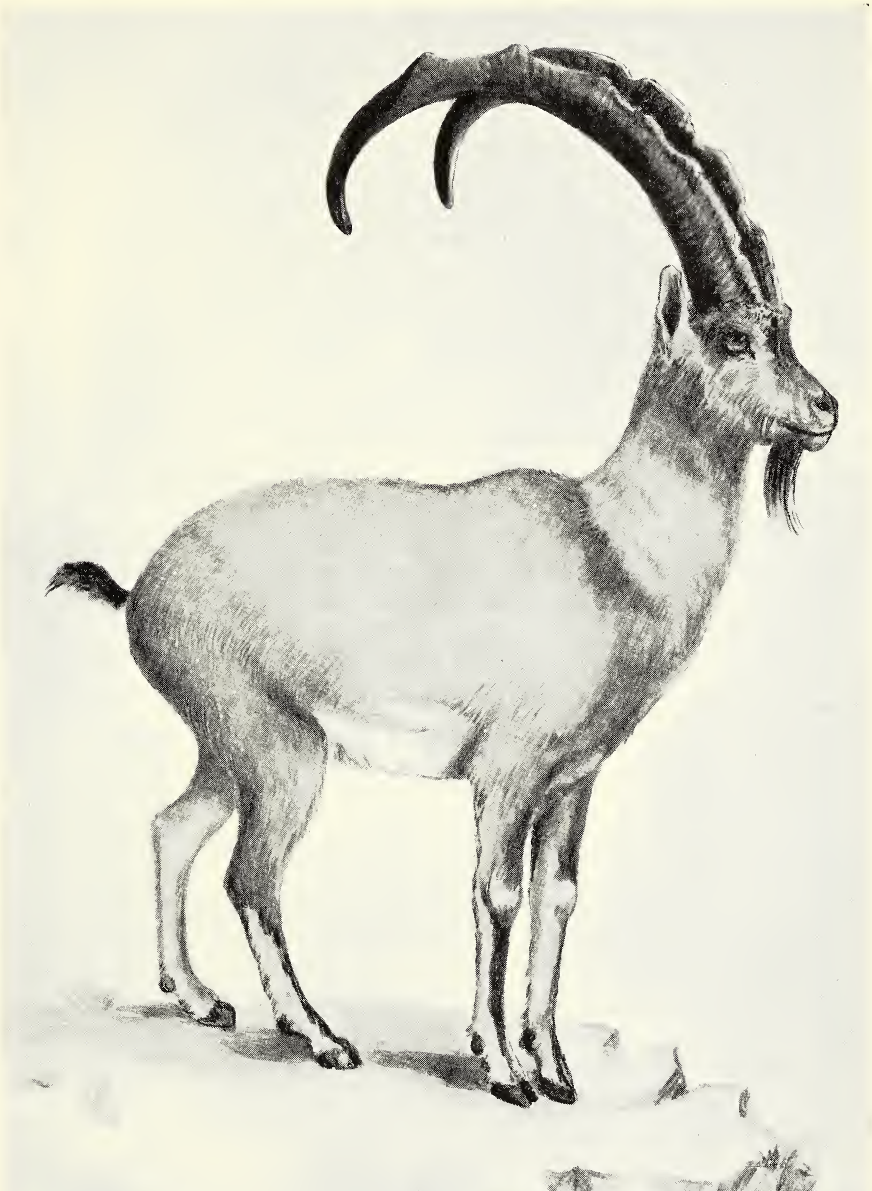
THE SIND WILD GOAT (*CAPRA HIRCUS BLYTHI* HUME).

The Sind Wild Goat is a relative of the wild goat of the Caucasus (*Capra hircus aegagarus*). It is distinguished by its smaller size. The species is of special interest as being the chief ancestral stock from which the various breeds of domestic goats are derived. A full grown buck is from 32 to 37 inches at the shoulder—a handsome bearded goat; brownish grey in winter, close haired, yellowish or rufous brown in summer. The under parts are whitish. Old males are lighter coloured. Well grown bucks have a dark stripe running from the nape of the neck along the back to the root of the tail and a cross stripe down each shoulder. The face, the chin with its beard, the throat, the tail, front of the legs, except the knees and a stripe along the flanks are dark brown. The horns are long and scimitar like. They sweep back in a graceful curve. Unlike the flat and regularly knobbed horns of the Ibex, they are compressed in front into a narrow jagged keel. The record length is about 52 ins. Anything over 40 ins. is a good head.

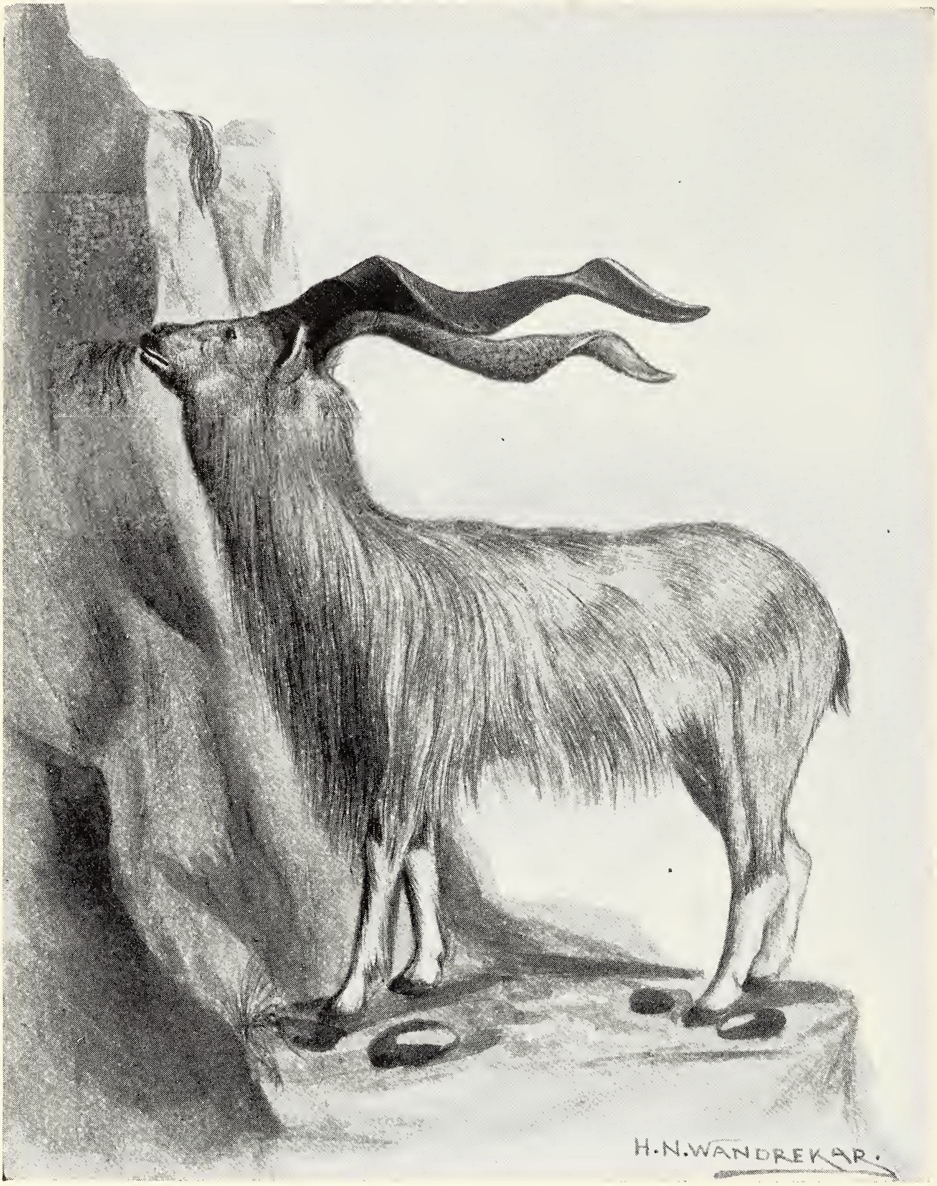
The Sind Wild Goat lives in small or large herds. In the barren hills of the Khirthar range their environment is one of jagged rock and loose stones, thorn and cactus with little or no water—a furnace of heat in summer; freezing cold in winter. Like all goats they are active, agile and surefooted leaping from ledge to ledge, stopping short on the steep hillside to balance on a pinnacle of rock where there is scarce a foothold. They go to rest on some commanding ridge from whence the sentinels of the flock can obtain a view of the surrounding slopes.

The 'bezoar stone' formerly famed in Europe and regarded in the East as an antidote to poison and as remedy in many diseases is a hard concretion found in the stomach of this goat.

The Sind Wild Goat inhabits the barren hills of Baluchistan and Western Sind, but not east or north-east of the Bolan Pass and Quetta. Here it is replaced by the Markhor.



The Sind Wild Goat (*Capra bircus blythi*, Hume).


H.N.WANDREKAR.

The Pir Pinjal Markhor (*Capra falconeri cashmiriensis*, Lyd.).

THE MARKHOR (*CAPRA FALCONERI* WAGNER).

The Markhor, the grandest of all wild goats, stands about 41 ins. high at the shoulder. An old male, with his great horns, flowing beard and his mane, falling from his neck and shoulders to his knees, has a dignified and patriarchae appearance. The long and silky haired winter coat is a rusty iron grey; in summer, the hair is shorter. It takes a reddish brown tinge. Old males become more or less white. Young bucks are equally shaggy though not as copiously bearded as the veterans. Female are dark fawn and about half the size of a well grown male. Some wear a scanty beard. Markhor carry magnificent horns. These show more or less constant variation in form in different areas. Otherwise there is nothing to really distinguish the 4 known races. The typical Markhor (*Capra falconeri falconeri*) inhabits Astor. In this area the horns diverge widely and form an open spiral. The maximum recorded length is 60 ins. Horns of this type are also seen in Baltistan and Gilgit. Markhor from the Pirpinjal and Kaj-i-nag Mountains (*Capra f. cashmiriensis*) have horns which diverge less and, in fine heads, show two complete twists or spirals. The record is 65 ins. This type is also common in Baltistan, Gilgit and Chitral. In the hills on the northern edge of Peshawar, the horns lose their imposing spiral and assume the straight corkscrew pattern, typical of Markhor living in the mountains of North Afghanistan. The race is known as Kabul Markhor (*Capra f. megaceros*). The straightening of the horns and the accentuation of the spiral twist reaches its extreme in the Suleman Markhor (*Capra f. jerdoni*), which is found in the Suleman Mountains in the Trans-Indus District of the Punjab. The Markhor of the mountain ranges of Baluchistan, curiously enough, show two forms of horns—one, resembling the wide spanned Astor type and the other the Pirpinjal form with its more modified sweep.

The character of the country through which Markhor range varies greatly. The Sulemans and the hills of the North-West Frontier are covered with thorn and scrub and exposed to terrific heat in summer. There Markhor must live under very different conditions to those whose environment is the pine forests and snow bound scarps of the mountains of Kashmir. Markhor associate in small herds usually selecting the most broken and precipitous country. They do not like snow and seldom go higher than the snow line and, in winter, descend to comparatively low levels. Their sensitiveness to cold is attributed to the absence of under-fur or *pashm* with which the Ibex is so well provided. Unlike Ibex, which keep to the rugged ravines above the tree line, the Markhor delights in rocky forest and seeks concealment as much as possible. They are sometimes in large mixed herds but in summer the veterans generally live apart, alone, or four or five males together. The rut is said to take place in December in the Himalayas and in October and November with the straight horned races.

(*To be continued*).

THE PRESERVATION OF WILD LIFE IN INDIA.

No. 1. *THE CENTRAL PROVINCES.*

BY

A. A. DUNBAR-BRANDER.

(*Late Conservator of Forests, Central Provinces.*)

Game Country: Status and Jurisdiction.

Good game tracts exist both in Indian State and in British India.

The British Government has no jurisdiction over the game in Indian States. Most of the Indian Princes protect game, and there is a growing tendency for this movement to spread and become more vigorous. In most States the laws or rules for the protection of wild animals are effectively enforced.

No more need be said about the States. With regard to British India, game is found in country having a different legal status, and this must be differentiated:—

(*a*) Private land.
(*b*) State land.

Generally speaking, game in (*a*) has no owner. It belongs neither to the owner of the land nor to the State. The Government, however, has the right to pass laws regulating the slaughter of game, and in most cases such laws have been passed. I shall refer to this in more detail when dealing with game laws.

With regard to State land the great bulk of which consists of Government forest, the State owns the game, and special laws dealing with its protection throughout India have been passed. These laws are administered by the Forest Department. I shall also refer to this in some detail later on.

Types of Game Country.

There are four main types of country in which game is found and which I have designated as follows:—

(1) Himalayan.
(2) Terai.
(3) Central Plateau.
(4) Southern.

Position with regard to Protection in each Type.

Himalayan.—The terrain in which the game is found is its chief protection. To destroy it entails arduous and whole-time work, quite incompatible with any prospective profits to the poacher, and, save with regard to certain species which frequent the outer hills, no special measures are called for with regard to this tract.

The Terai.—Very much the same applies to the Terai, but for different causes. This tract of country extends from Dehra Dun along the Himalayan foothills eastward into Assam and thence southward towards the Bay of Bengal. In it the jungle and grasses are so dense that no serious slaughter of game can take place without the extensive use of elephants. These, of course, cannot be employed without sanction and regulation. The amount of game and species to be killed can, therefore, be regulated; game is holding its own and no special measures seem called for in this tract.

The Central Plateau.—This tract embraces the great mass of India and was at one time the finest shooting country and contained the finest fauna in the East. The forest is generally open and although often hilly the hills are no deterrent to a hunter. Unlike the other tracts, nature of the terrain in the Central Plateau is an inadequate protection. Further, the game-holding tracts are not only surrounded by a dense population, but a large interior population of aborigines exists inside the forest itself, to an extent not found in the other tracts. It is in this tract that the recent disappearance of game has been so lamentable and calls for the most urgent remedial measures.

I left India in 1922 but revisited it in 1928, and was appalled to find such a change in so short a period, quite common species being found only with difficulty. The finest game country in this tract is found in the Central Provinces, and I shall deal at some length with the causes which have brought about this state of affairs in that area, as I believe they have a very wide application.

The Southern Type.—As I do not know this country personally I write about it with some diffidence. I have, however, taken a very deep interest in all that pertains to game during my whole service in India, and I believe the following to be fundamentally true. The country is very mountainous and the cover is often dense: less mountainous, of course, than even the outer spurs of the Himalayas, and less dense than the Terai. Nevertheless the combination of these two factors in the same area makes the destruction of game by no means easy; and so far as I know the game is fairly well holding its own except in outlying portions.

Position of Game on Private Lands.

As already stated, the game in private lands has no owner. The State has passed laws prohibiting the killing of does and immature animals, sitting over water, and the use of various methods of destruction. To all intents and purposes the laws are a dead letter as there is no preventive staff. The two main preventive services in India are the Police and the Forest Service. The latter has no jurisdiction outside State forest, and the Police take no interest in enforcing the rules. Prosecutions are very rare, and any interest the local constable may take in the matter would often be to share in the booty. The result is that game has almost disappeared from private lands. The main Bombay-Allahabad line runs through some 200 miles of antelope country. Twenty years ago one was almost constantly in sight of herds. In 1928 in four hours I only saw two small herds, watching from the train. The only fauna left in private lands is a few chital and sambhar in specially favoured localities, pig in considerable numbers, and a sprinkling of antelope, also lesser carnivora.

The great mass of the country, however, is blank and it will be readily understood that these blank unprotected spaces surrounding Government forest which contain game act as a constant drain on the stock of fauna in the protected lands: there is constant leakage to destruction. In my opinion nothing can save the fauna in these private lands. Its extermination is certain. The people have been educated to destroy it: there is no staff to protect it, and even if the Indian Legislatures could be induced to take measures, financial considerations preclude adequate protection.

State Lands: Position of Game.

These mostly consist of State forests where the Forest Act and the rules made thereunder apply; amongst these are included the rules regulating the killing of game. On the whole, these are excellent, and, although I shall suggest certain stiffening to meet modern conditions, nevertheless it is not in the rules themselves but in their application that failure arises. As regards the European and Indian sportsmen who enter the forest to shoot under permit, the rules are absolutely efficacious, and this type of sportsman does no harm. Where they fail is in the prevention of poaching. There is lucrative trade in game; the initial detection of poaching often rests with a lowly-paid forest guard. Men possessing guns often command respect, and the guard finds the easiest plan is to take a percentage of the profits. Moreover, special rewards, which the rules sanction in poaching cases, are far too sparingly given, and the magistrates' sentences are often quite inadequate.

The Main Reasons why the Destruction of Game has Recently Increased.

(1) During the war the rules were relaxed. In certain cases the shooting of does was permitted to make leather jackets for sailors. There was a general activity in the trade in the products of game: tanneries came into being, and what was previously an occasional trade has now become an active competitive one with wide ramifications: a slaughtered deer no longer means merely a gorge of meat for the local aborigines, it is an article of commerce and a valuable one.

(2) There has been a very large increase in the number of gun licences issued as well as a large increase in unlicensed or illegal guns. It is easy to see that with a large number of guns legally possessed, the detection of illegal guns becomes more difficult.

Be the causes what they may, the State forests are surrounded by guns, many of which are constantly used in destroying game both inside the forest and just outside it. In the present political situation any attempt to regulate the number of guns to actual requirements for crop-protection is hopeless. The guns have come, and to stay.

(3) *The Motor Car.*—This is perhaps the biggest factor of all, in the disappearance of game, although without the two previous causes its significance would be small. Since the war whole tracts have been opened up—in fact no tract is inviolate—cars penetrating along dirt tracks into country in one day which previously took a week's marching with camels and horses. Every car that moves by day or night has one or more guns in it, and practically every animal seen which presents a fair chance of being killed, without further questions asked, is fired at. Moreover, expeditions go out at night with strong moveable searchlights and shoot down whatever is encountered, and the car enables the booty to be removed. The destruction is terrible. I came across glaring cases during my short three months' trip in 1928. The present game laws were framed before this menace arose, and they require to be reviewed and amended in consequence.

Some Remedial Measures Suggested.

(1) An attempt to check the increase of guns, even reduce them.

(2) Much stricter control and regulation of tanneries and businesses trading in wild fauna and its products.

(3) Complete review of the rules so as to deal with the motor car amongst other things, and to bring the owner and the driver of any car within the penalties of law-breaking.

(4) Press for stiffer sentences in poaching cases and rewards to subordinates detecting the same. These rewards are at present optional, but should be made as a matter of course, save for definite reasons.

(5) Establishing associations for the protection of Wild Life and housing enlightened Indian opinion, and enlisting influential men as members of such Societies.

Sanctuaries.

As will be seen from what I have written above, the Himalayan and Terai areas are hardly suitable places, even if required, in which to create National Sanctuaries. With regard to the Central and Southern areas, the case is different. In these tracts they will form a useful and interesting purpose, especially in the former, where the fauna can be readily observed, will readily tame, and be a delight to visitors.

My knowledge of the Southern tract does not enable me to suggest any particular area, but as I know every square mile of the Central Provinces I can definitely assert that one area is suited *par excellence* for a National Park. This is known as the Banjar Valley Reserve.

The Banjar Valley Reserve.

Situation.—Situated in the South Mandla Forest Division, 30 miles south-east of Mandla, which is the District Head-quarters.

Mandla is almost 60 miles, due south of Jabalpur, and served by first-class road and light railway. There is a fair weather motor road from Mandla to Khana in the centre of the valley.

Maps.—Splendid forest maps on the 4 inch to 1 mile scale made by the Forest Survey can be got from the Map Office, Dehra Dun. These show 25 feet contours, and, if desired, maps showing grass-lands, sal forest and mixed forests (Stock Maps) can be purchased.

Area.—From memory the area is about 40,000 acres, but for the purposes of a National Sanctuary some 30,000 additional and adjoining acres should be included. The Banjar Valley is merely a name given to a forest unit.

General Description.—Broadly speaking the area is a huge amphitheatre surrounded in a circular manner by a range of hills about 3,000 feet high. The bulk of the area is within these hills, but the forest extends down the outward slopes of the hills until the cultivated plains are reached. It is well watered throughout, but this of course could be improved, especially on the hill-tops.

The low-lying portions consist of grass maidans or open plains, young trees being cut back annually by frost. As soon as the contour above the frost level is reached pure Sal (*Shorea robusta*) forest is found. This, however, only extends a short way up the hillsides, where it gives place to the usual mixed forest of 200 or 300 species and bamboos. The rock and soil are metamorphic sand with occasional pockets of black cotton soil.

The Game.—In 1900 this tract contained as much game as any tract I ever saw in the best parts of Africa in 1908. I have seen 1,500 head consisting of 11 species in an evening's stroll. It is nothing like that now, but it is still probably true to say that it contains more numbers and more species than any other tract of its size in the whole of Asia.

Banjar Valley.

Game.—The following species are found in many numbers:

Bison	common	Nilgai	scattered
Swamp deer	common	Bear	common
Sambhar	common	Tiger	common
Chital	common	Leopard	common
Barking deer	common	Wild dog	common
Four-horned antelope	common	Hyaena	a few
		Jackal	common
Mouse deer	common (not often seen)	Fox	a few
		Porcupine	common
Black buck	two good herds	Pig	common

and a mass of small rodents and carnivora as well as Langur monkeys.

Chinkara are found on the outliers outside the reserve but rarely.

It will thus be seen that the tract contains all the game animals of the plains of India except chinkara, elephant, buffalo, lion. In 1900 elephants and buffaloes were regular rain visitors. The latter would probably return if given encouragement.

Legal Position.

This area is one of the oldest State reserves and belongs to Government. It contains valuable timber and is policed and administered by the Forest Department. Government would not care to give up working the valuable timber in the area, but this need not interfere with the Sanctuary.

It is essential that the area remain State Forest, otherwise the Forest Act would not apply. Also it is absolutely essential for our purposes that the Act should continue to apply. Some form of 'dedication' could no doubt adjust this as there is no incompatibility.

If the Act applies, as it must, and if the Forest Department continues to manage the Forest (timber), as it will, it is clear that our staff must be also the Forest Staff. Otherwise there will be two staffs in the same area, and one will be in opposition to the other. Moreover, the Forest Department has managed the game in India, against great difficulty, with signal success in most cases, and to deprive them of these functions would create resentment, especially, unless it could be shown to be reasonable and necessary.

Banjar Valley.

The shooting of game is strictly regulated, but a tremendous lot of poaching takes place. Part of it is always sanctuary, but these sanctuaries which are found in numbers in all districts are merely administrative shooting sanctuaries, resting blocks, pending opening to shooting again. They have nothing like the status of a National Sanctuary.

Some Suggestions.

The local Government might agree to the area being declared a National Sanctuary but would, I consider, be more inclined to give the proposal favourable consideration if it was initiated by Indian gentlemen. It might, therefore, be the best course to first obtain the support of the non-official members of the Legislative Council and it is believed that the conservation of Indian wild life for the benefit of the Indian People is a plea which no party can lightly thrust aside.

Conclusion.

I consider that action in India is urgently required, perhaps more so than in Africa. There are I know questions of detail which apply to particular areas and particular species which I have not touched upon but in the above I have attempted to tell you something about India as a whole, and in particular what definite action that might be taken in the Central Provinces.

No. 2. *THE BOMBAY PRESIDENCY.*

BY

G. Monteath, I.C.S.

It is five years since I left India, and a good many more since I was last in some of the Forest districts in which I have served. Those that I knew are all, with the exception of Thana, in the Central and Southern Divisions of the Presidency. Sind and Guzerat; Surat, the Panch Mahals, and the Dangs are 'terra incognita'. Anything I say therefore is subject to the qualification that my personal knowledge of conditions is limited to certain districts, and my experience hardly up to date.

In some Forest districts a heavy decrease in the numbers of certain species—those that afford, in addition to the sport of hunting them, desirable trophies—had taken place before the question of protection began to be considered seriously and rules were made under the Forest Act to impose some limit on killing. It must be admitted that up to that time—that is till after the beginning of this century—the main agent of destruction was the 'European' sportsman, to give him the title established by long usage in India. Neither the indigenous 'shikari' nor the wild dog—two kinds of 'poacher' frequently accused—can properly be blamed for it.

To take the villager first—his share of the damage done in the past in this part of India, where, as far as I have been able to find out, he has had no inducement of profit worth considering, is negligible, and his present activities hardly make enough impression by themselves to counterbalance the natural increase of the species he is generally concerned with. His usual method of hunting—a long and wearisome, and more often than not fruitless, watch by night, whether lawfully in his field or unlawfully and surreptitiously over water or a game-path in the adjoining forest—practically precludes such a result. He is little, if at all, more efficiently armed, and it is scarcely to be supposed that he is a better marksman or sees better at night, than his predecessors—most of whom, as Forsyth says, were bunglers at this kind of work. When a number of villagers combine, as they sometimes do—most often in my experience in the Kanara district—with nets or dogs or both, they may do a little better, but even these hunts are not on the whole, I think, much more productive of result than the solitary watch. The fact that they are illegal makes it necessary to keep them as dark as possible, and since they cannot be conducted without numbers and some noise, secrecy—unless there is connivance on the part of local subordinate officials—is not altogether easy. They do not therefore take place very often, and when they do the total result after a good deal of work, involving much careful preliminary investigation and placing of nets, hardly, according to my observation, warrants the conclusion that this kind of hunting causes any real decrease in the numbers of the species that is their main object—

in the Kanara district for our purposes cheetal, which seldom go far from the comparatively easily worked forests adjoining village sites. I say 'for our purposes' because I am dealing just now with forest species that are in need of protection. Pig of course are hunted too—pig and cheetal are the two kinds of forest dwellers that do most of the trespassing on cultivation that villagers complain about—but pig are prolific and in no need of protection—in Kanara perhaps rather the contrary. Cheetal also, if considerably less prolific, have still a natural rate of increase that would more than counterbalance the occasional killing of a few of them by villagers, as long as this was all they had to fear. Provided that due care and discrimination are exercised in the matter of gun licences for crop protection, there is not very much danger that the occasional unlawful use of a gun will do more harm than it has done in the past, and the evidence seems to show that this has been inconsiderable. In fact, if the grant of licences for smooth-bore guns—which are all that is needed for protection of crops, and all that villagers usually want (most often single-barelled ones and nearly always muzzle-loaders, for financial reasons)—is proportioned to the area of cultivation (and of course conditioned by the respectability of the individuals concerned), inhabitants of forest villages will do very well, other things being equal, if they hold their own against deer and pig. If sometimes for the sake of meat one or another of them sits up with his gun in a forest, or a number of the 'lads of the village' combine for a hunt with nets and spears (in this case usually their only armament, for guns are noisy and likely to be more dangerous to hunters than hunted) and they happen to be caught at it, I should be inclined to be lenient with them. After all it is arguable that the motive is as good a one as the desire for a trophy, which if the animal shot is a large one—say a bison—often involves, in Kanara at any rate, almost entire waste of the carcase.

Trade in hides and horns.

If there was money in it for the villagers, illicit hunting in Forest districts might be a more serious matter, but I never found much evidence of that kind of inducement. No doubt there has always been some illegal trade in 'Forest produce'—horns, hides, or meat for the purposes of this article—and no doubt it continues. Sambur leather I know is exported to England, but I do not think much, if any, of it comes from our part of India. I could never in fact discover that there was enough of this kind of trade in the districts I knew to matter very much—unlike some Provinces, to judge by what I have heard and read—or that most of what there was was done through the agency, or to the pecuniary advantage, of Forest villagers.

Protective Legislation.

However, such trade is admittedly illegal, and under modern conditions could increase very considerably in the absence of more effectual obstruction than seems to be possible at present, owing, I gather, to the interpretation so far allowed of the words 'Forest produce', which makes it incumbent on the prosecution to prove that any animal that is the subject of a case was actually killed in Government Forest. Certain animals are forest-dwellers wherever they may happen to be at the moment they are killed. It is not in this context the killing that is the offence, but commerce in certain kinds of 'Forest produce', an offence which by its nature is, in part at any rate, committed outside Forest limits. The contention that the particular animal in question was killed elsewhere than in Government Forest ought not in fact to be relevant. At least the burden of proving it should be on the defence (though I doubt whether that would get us much further). If an amendment of the definition is likely to be of use it would probably be easy to make it, but I think myself that what is wanted is legislation of a wider scope, to include animals that are normally found in non-forest country, for at the present time they are in a more parlous state than the others.

I said that up to date there was not much of this kind of trade in the Bombay Presidency, or rather that I had not seen much evidence of it up to the time when I left India. It has been a problem however in some other Provinces. I read for instance not long ago in the '*Field*' that in Assam similar difficulty of proving locality had been an obstacle in the way of effective protection of rhinoceros, for which there are sanctuaries. Under the conditions of today the question is quite likely to become a good deal more serious here than it is as yet, and steps ought to be taken in time—our present 'hunting and shooting' rules were made almost too late for some districts, and altogether too late to save certain species in them. It is not the local villager but a different kind of 'poacher' that we shall have to look out for, and it is I think about time to get ready for him. I will come back to him later.

Predatory Animals.

Before I go on I had better dispose as well as I can of the case against the wild dog, a very interesting creature with a bad name, for he shares in some degree with the inhabitants of villages in or adjacent to forest the odium of causing game to disappear faster than it can breed. There is a good deal of misapprehension about the actual amount of damage done by wild dogs, based partly on the impression they give of being much more numerous than they really are, and partly on the natural exasperation and prejudice caused by the fact that when the visit of a troop synchronises with that of a sportsman to a particular bit of jungle they undoubtedly often spoil the latter's chances, since the game is for the time being more or less disturbed, and the local tiger, finding his hunting interfered with, moves off. But a troop seldom remains in one place more than a few days. It makes its kill—with luck perhaps a second kill—and departs, and is seen again perhaps twenty miles away, creating the illusion that there are twice as many wild dogs in that area of forest as there really are. The game settles down again, the tiger returns, and the *status quo* is restored as soon as the dogs disappear, and it is a fact to be noticed that their most regular visits are to those places in which deer—their usual quarry—continue to be numerous.

Predatory wild animals do not, till man intervenes, increase out of proportion to their food-supply. Another thing to be borne in mind is the wild dog's method of hunting, which, like that of his co-accused the local villager, seems to me to settle the contention that he does enough damage to justify his proscription. The whole troop of dogs hunts one animal—most often a female or a young one—and sticks to the line (a pack of hounds might learn a lot from them) till that animal is run into, which may take half a day or longer. And a fair-sized troop hardly eats as much at a meal, so far as I have been able to observe, as one able-bodied tiger. I would do away with the price put on the wild dog's head—it is unnecessary for one thing, and for another I have never known it claimed. Instances could be given in support of what I have said, but this article is likely to be long enough without them.

I have argued this subject with Forest officers, some of whom were disinclined to agree, but it seemed to me that they had not thought much about it. I used myself to accept what was told me about the '*jugli kutta*' but long ago came to the conclusion that most of it was, to say the least, exaggerated. Certain Forest officers however of great experience did agree with the views I have just put forward—there is no harm in mentioning here that one of them is Mr. T. R. Bell, Late Chief Conservator of Forests, Bombay Presidency.

Local Conditions.

Some of the old books about 'Wild Sports' in India—classics of their kind—show how little the keen sportsman in the past, District officer, or soldier, or whatever his vocation might be, thought in the midst of comparative abundance about the future, and that the idea of protection of any kind—even of a close season other than what might be enforced by the season of the year—hardly occurred to him. Too often, as in Africa, he slew while he had the opportunity and spared not—(only in India we have not had the professional hunter). Even in Forsyth's time the result was beginning to be apparent, for 'now-a-days' he complains (writing of bison in Nimar as far as I remember—I am quoting from memory) 'a keen and active sportsman on a fortnight's leave would be lucky if he kept up his average for that period to one bison a day'. Fourteen in a fortnight—a poor bag! I do not know whether there are any bison left now in the Khandwa district—there are none in that part of Khandesh which adjoins it.

The aggregate of execution done in any area depended naturally on its accessibility from large cities, cantonments, or railway centres—in other words on the number of sportsmen that would visit it in a year. We have a good enough example in the Bombay

Presidency in a comparison of the state of things in North Kanara with that in Thana at the time when rules and a system of licensing were first put into force. In the latter district when I left it bison survived only in a small herd in one part of the forests, and today I am told are extinct: sambur were scarce: cheetal though pretty widely distributed were in small and scattered herds (and I need hardly say that their size generally indicates fairly well whether species that habitually go in herds are plentiful or not): the usually harmless bear, which, like bison, had been not uncommon twenty or thirty years previously, had disappeared altogether. Most parts of Thana, with its two main lines of railway and a sufficiency of tolerable roads, were easy enough of access in pre-motor days from Bombay, Poona, or one of the two or three hot-weather resorts on its borders, to make it worth while for any one with a taste for 'shikar' and only two or three days—say a week-end—to spare, to spend them on a shikar expedition in the Thana district. Kanara was a different proposition. Even after completion of the Southern Maratha Railway it took a good deal of time to get to Kanara for any one not resident in one of the adjoining districts, so that considerable preparation and 'bandobast' were necessary. Short expeditions repeated at more or less frequent intervals were consequently for most people out of the question. So when 'rules and regulations to govern hunting and shooting' were made there was still in Kanara plenty of game of all the species indigenous to it. It can hardly be argued that the local 'poacher' was so much less efficient in Kanara than in Thana as to account for the difference between the two districts, and the conclusion seems to be obvious.

Local Regulations: (1) *Southern Circle.*

The regulations in force in the Southern Forest Circle are in one main respect different from those governing the forest areas of the rest of the Presidency, in that the former include, and are in fact based on, the Central Provinces 'block' system. Mr. Bell and I drew them up in consultation, and they were sanctioned in the face of some opposition on the part of more than one Divisional Forest Officer, but I think Forest Officers in the Southern Circle would be sorry now to see the present system done away with and the old one reverted to. Elsewhere the views of those consulted prevailed, namely that the existing rules were good enough and the 'block' system was unnecessary and not easily workable in their circles.

That the present state of things in the Southern Circle forest areas is on the whole, as I think it is, satisfactory, is attributable mainly or very largely to the fact that the 'block' system and attendant rules were introduced in good time, that is before the general use of motor transport had begun to make many parts of North Kanara so much more accessible than they were in former days. The restrictions imposed by the old rules—consisting of little more than the necessity, for the purpose of shooting in Government forests, of buying a licence available for a year, and a limit of the number of head of certain species that might be shot by an individual licensee—would hardly have been enough by themselves to counteract the effect of a much greater annual influx of sportsmen, with the inveterate tendency of the majority to follow one another into well known and favoured localities. The system now in force seems to provide as adequately as any set of regulations can against overshooting of those parts of the Southern Circle forests to which it applies by means of a three-fold check. First the ordinary form of licence, that for a block, is valid for a certain period, during which the' licensee has a virtual monopoly of that block. Secondly, there is the definite limit to the number of certain species that may be shot in a year by one licensee. The third and perhaps most important check is the limit to the number that may be shot in one block—it varies of course according to conditions, but when the number fixed for any block is reached in respect of a particular species no more of that species may be shot there for the rest of the year. These provisions seem sufficient to counteract over-shooting on licence. Obviously their effectiveness depends a good deal on co-operation on the part of sportsmen, for instance by reporting any cases noticed of unauthorised shooting or other breaches of the law and by furnishing correct returns of their own 'bag'. Such co-operation though occasionally an individual may be neglectful about his return, can for the most part be counted on.

All this has so far worked very successfully. The additional provision, by which certain blocks may be closed altogether to shooting for a series of years in a rotation which depends on the responsible Forest officer's observation of the stock of game completes the general measures for protection in the Southern Circle. In the result the position there seems, as I have said, to be on the whole satisfactory. Bison are apparently safe enough—they have nothing much to fear except rinderpest, and although at intervals they have suffered rather heavily from that, the intervals have been fairly long ones, and their numbers have been made up again, with the assistance of judicious closure, more rapidly than might have been expected. Sambur and cheetal are in little danger from the licensed sportsman, the indigenous shikari, or their natural four-footed enemies. I particularise these species because of forest species in the Bombay Presidency it seems to be they that chiefly require protection. Others are either not much sought after or are pretty well able to look after themselves, although I should like to put in a word for that interesting character the bear. I do not know that many bears are shot in the Southern Circle, perhaps not enough to warrant a limit being placed on the number assigned to a licence, but it is to be remembered that they were once fairly numerous in Thana and have disappeared from that district. They are nervous creatures and apt to be hasty in action if startled, but generally speaking do no harm. It is a suggestion which I put forward for what it may be worth. About elephants I do not feel myself qualified to make any suggestion at all. At present I believe there is *carte blanche* to shoot them, owing to their destructiveness to crops, a proposal to institute 'Kheddahs' or adopt some other means of capture having come to nothing. But it is likely that their case will sooner or later call for reconsideration. I do not believe that the total extent of their depredations is great, though of course that is no consolation to the individuals whose crops may happen to find favour with a herd.

It is unnecessary to go further into details in regard to the Southern Circle regulations, and in fact, though I helped to draw them up, my recollection of details is not very definite; but there is just one rule in which I should like to see an alteration made, namely that which lays down a fine for the killing by a licensee of a female of any of certain species. In practice, as far as I remember, the maximum fine was more often than not exacted in such cases. It is an irritating rule, and unnecessary in my opinion. Nobody shoots a female on purpose, and with species that ordinarily go about in herds marriageable females predominate so much over mature males that the occasional accidental killing of one of the former does no harm—it may indeed be beneficial, since the female killed in mistake for a male (it is most often a bison) is likely to be pretty well on in years. It seems unfair that an error of judgment that is practically innocuous and usually made known by the licensee's own report of it should involve a penalty—the maximum fine in many, if not most, cases—while the offence of unlicensed shooting goes so often unpunished because it cannot be brought home to the offender. It might very well be laid down that if a female of one of the 'scheduled' species is shot by a licensed sportsman and the fact duly reported, it should count as one of the number allowed by the licence. Such a provision would do no harm at all, and the sportsman would probably be more cautious in future about believing what his orderly or shikari told him.

(2) *Northern Circle.*

So much for the Southern Circle. The position, as was said above, is less satisfactory elsewhere. What it was like in Thana when I left that district—rather a long time ago—I have roughly indicated, and one can hardly suppose it has improved, regulations notwithstanding. Khandesh—or East Khandesh, the part I knew—was better off. The bison had gone, but there were plenty of sambur and, in practically the only locality in the district in which they are now found, there was a pretty good stock of cheetal. I believe at one time, not very long before I came to Khandesh, these had diminished considerably in numbers from over-shooting, but owing to measures taken by Mr. Simcox—a short open season, a limit of one head per licence, and the prohibition of any form of hunting other than stalking on foot, or, more accurately, 'still-hunting'—they recovered rapidly, and in a few years were again numerous. But I doubt whether measures that were ample for their purpose when horse-back, or that instrument of torture the Khandeshi 'chakra', was the sportsman's ordinary method of getting to his destination will be enough by themselves to prevent over-shooting in the future, now that it is easy to reach the chosen spot by motor car. It will probably be found necessary sooner or later here as in the Southern Circle to limit the total number of head that may be shot during the year, and the only way of enforcing such a limit seems to be the way in which it is done there. I have never been able to see any difficulty in using the same system that has proved its value in one part of the Presidency in any other district of it in which there is enough forest, and *ex hypothesi* enough forest fauna, to make rules of any kind for protection worth while at all. If the 'block' system can be worked in Khandwa it can equally well be worked in Khandesh, and unless it is introduced in Thana I doubt if effective protection is possible there. It may be admitted freely that the well-armed sportsman of today, 'European' or Indian, is usually, apart from legal restrictions, more moderate of his own accord than his predecessor, and that his presence is of definite assistance to the Forest officer in the latter's role of game-keeper. Nevertheless, whatever limits are laid down for the individual, their object is pretty certain to be defeated in the end by any considerable increase of the numbers that visit a given area, if there is no further check. It has proved to be the case elsewhere. If the Thana forests—to take that district alone—were divided up like those of Kanara it should be possible even now to increase the head of sambur and cheetal (bison I am afraid are past praying for) by systematic closure of a certain number of blocks in rotation, for as long in each case as the results observed from year to year showed to be necessary, the areas open to shooting having of course each its own annual limit as in the Southern Circle. An obvious advantage of the system over the old one is appreciable simplification for the already hard-worked Forest officials of the task of supervision.

With districts in the Northern Division other than Thana I have no acquaintance, but my impression is that they are not now-a-days much visited by non-resident sportsmen except for small game shooting. The existing rules may be enough in their case for the time being, but if at any future date the forest areas of these districts came more into favour with the seeker after larger game it would no doubt be well to make the changes just advocated for Thana and Khandesh.

Sanctuaries.

To sum up, the system of licensing that is in force in the Southern Circle having so far proved on the whole adequate there for its purpose, its extension to other parts of the Presidency where there are considerable tracts of forest in fairly regular request for shooting seems desirable. In fact I can see no other means at present available by which the gradual disappearance of the species most generally sought after may possibly be stayed, or the stock increased. Nor can I think of any further measures in supplement that would be feasible. The establishment, for instance, of sanctuaries on the lines of the African Game Reserves (but of necessity on a smaller scale), which I have seen advocated for some parts of India, and which may (though I doubt it) be a practical proposition for them, is manifestly out of the question for Bombay, and likely to be so for a long time to come. Expenditure on a special establishment to look after them could never be justified, and the burden of supervising much larger areas closed to shooting, which would consequently fall on the Forest staff, would be made no lighter for them—rather the contrary—by the absence as a matter of course of licensed sportsmen. Sanctuaries indeed other than those of manageable size provided under the rules by temporary closures of blocks, plus such natural ones as still exist in parts of different districts by reason of inaccessibility combined with climate, might very well in the end prove to be no sanctuaries at all.

Wild Animals in Non-Forest Areas.

If it may be granted that in some of the districts that have considerable areas of forest the state of the native fauna is not unsatisfactory, and in others of them is still capable of improvement, it is very different in the non-forest parts of the Presidency, that is of course in much the greater part of it. Antelope and gazelle (blackbuck and chinkara) when I left India had begun to disappear from many places where they used to be numerous, and doubtless the process continues. Here again local 'poachers' may be acquitted of blame, if one can call 'local' the peripatetic sort—Pardi, Haran-Shikari, or whatever his label. The ordinary villager seldom bothered his head about blackbuck, further than to scare them away from his crops. The others, from time immemorial, have wandered from one place to another—a gang of them does not want to camp long anywhere, and could not if it would, for they are 'criminal tribes' and the Police see to it that they move on. Their numbers are not large, and their painstaking method of snaring their quarry never produced results worth considering. They may do better with partridges and quail, or hares—I am inclined to think they do—but on the whole they can be counted out. Nor for that matter did the toll taken by the sportsman in the past affect perceptibly the stock of these species—blackbuck quickly learnt to adapt themselves to the range of improved weapons, and the chinkara is seldom an easy mark.

The extension of motor transport and the greatly increased number of licences for rifles are what has made the difference. The modern high-velocity magazine rifle of foreign make is cheap enough to be bought, even new, by many who could not have afforded the shorter-ranging express, and motor cars or cycles can go almost anywhere. Obviously any one who can own or part-own some kind of motor vehicle can also pay for a rifle—new or second-hand. He can often do so when he can only afford to travel by public conveyance.

Protection in Non-Forest Areas.

The difficulty of dealing with this comparatively recent departure is plain, and I must confess I can see no very efficacious way of doing it. Certain measures can of course, and should, be taken, but it is one thing to prescribe rules and penalties, and another to secure their operation, with no particular agency for the most part to rely on. Still, the knowledge that they exist might count for something.

So far little or nothing seems to have been done to limit killing of the species I am now considering. Yet they are clearly no less property of the State than the forest-dwelling species to protect which elaborate regulations are in force. The State is—in theory at least—the owner of all land in a rayatwari Province, with unimportant exceptions, and, as a corollary, of all game to be found on it. If indiscriminate slaughter of game animals elsewhere than in Government forests cannot be stopped altogether—and doubtless it cannot—yet it is time and more than time for some attempt to be made to delay its progress by rendering certain acts illegal.

A licence for the possession of a rifle can be granted for the purpose of self-protection, of crop-protection, or of sport, for all three purposes, or for any two of them. For self-protection a rifle is with rare exceptions unnecessary and unsuitable, and for crop-protection smooth-bore guns are the most that is needed. Remains sport. In the first place, then, when that is the ostensible object, the licence should prescribe certain definite restrictions on the species of game, and the number of each, allowed to the holder during the period for which it is available. The fee for it should be raised to an amount sufficient to emphasise its dual character—fire-arm and game licence: it should apply only to non-forest lands in the district for which it is issued, all fodder reserves or 'Kurans', whether in charge of Forest or of Revenue officials, being excluded: and the species allowed should be only those usually or frequently found outside the main forest tracts—in this Presidency blackbuck and chinkara, but not cheetal. Further, the licensee should be required, like the holder of a licence issued under the Forest Act, to furnish a return of what he has shot within the period of his licence. Such returns, on which very little reliance could be placed,—but they should be required all the same—could be rendered most conveniently perhaps to the Mamlatdars of the licensee's 'home' talukas.

So much for the licence to own a rifle (or gun) for sport, and the conditions to which it should be subject. The next thing to consider is the motor—privately owned, or public conveyance. It should be definitely forbidden, under pain of an adequate fine, to shoot from, or from the cover of, any kind of motor vehicle, and more especially to shoot by the aid of motor head-lights. I believe this prohibition already obtains in forest areas. The provision that no shooting at all should be allowed from or within a certain distance of a highway should be added in supplement, but it must be admitted that in any case, since cars can be—and are—taken over the roughest tracks across country, it would in practice be chiefly the users of public conveyances that these prohibitions would affect. Still, that would be something.

The last measure of those that I can think of is that to which I referred further back. The sale and purchase of meat or trophies of any kind of game animal, and not only such as can be brought within the definition of 'Forest produce', should be made illegal, and the penalty should be heavy enough to make both buyer and seller cautious. It goes without saying that the bribery of subordinate officials, by the present for instance of part of the meat of an animal shot, is 'illegal gratification', and it is equally clear that it is an offence nearly impossible to detect:—information offered by a jealous rival is about the only means by which it is ever brought to light.

The Motoring Poacher.

It was in this context that I mentioned that it was time to get ready for another kind of 'poacher'—one very different from and a good deal more efficient than the resident variety—and this brings me back to the forests, where he has already arrived, though he has not as yet perhaps done very much execution on the whole. The opening up by means of roads for the exploitation of timber of more and more of the high forest areas puts more and more places that were previously hardly accessible within reach of the man who can command the use of a motor car. So far not much advantage seems to have been taken by the unlicensed shikari of roads other than the main Public Works routes that run through forest land, and little damage has been done to species other than cheetal—the most 'get-at-able' for the motoring 'poacher'—but quite sufficient, I am told, to them in some places to give reason for anxiety. If he widens his sphere of operations by taking to Forest roads other species may suffer, but it should be easier to obstruct him here than on the public routes—he will be more noticeable and less mobile, and there is greater likelihood of his falling in with some of the Forest Staff. On the main roads I think the most that Forest officers can generally do is to keep these gentry moving, but the illegality of shooting without licence should be emphasised by adequate punishment of the offender when he does happen to be brought to book—including attachment of his gun or rifle, which may be unlicensed, or if licensed has probably been brought outside the district for which it is licensed. Ordinarily of course a licence to possess a rifle—or even gun—for sport should not be valid beyond the boundaries of the district in which it is sanctioned.

If distance and the offender's mobility combine to render the already hard-worked Forest official's task difficult in this respect by day, at night it will still more seldom be possible to catch the poacher in the act of poaching—he can get away too quickly. The most that can be done is to watch likely places for him at occasional and irregular intervals—a constant or regular patrol is out of the question—and trust that the knowledge that he may be looked out for, and if caught will be severely punished, will impair the accuracy of his aim. It must always be remembered that this sort of duty is not only arduous and discouraging in its results, but may at times be dangerous. It is a good deal to ask of a lonely Forest Guard that he should outbluff an armed and probably truculent man—perhaps two or three men—and he may well be excused if he sometimes looks the other way.

Agencies for the Protection of Wild Animals.

If things are thus difficult for the Forest staff in their domain it is clear that the Police—the only agency to all intents that we have in the very much larger non-forest areas—cannot be expected to do much in the way of enforcing the measures I have suggested. Inspection of fire-arms licences comes within the scope of their duties under the Arms Act, and that is almost all they can do. If a constable witnesses or is told of a breach of any of the rules—supposing that something like what I have indicated is done—he will, it may be hoped, report it, and the charge against the offender may be substantiated, but evasion is likely to be easy. The Police have too much to do otherwise for it to be possible to put any of them on special duty as gamekeepers. Local public opinion, what there is of it, will probably be on the side of the offender rather than of the law. If there were large zamindaris in this part of India the problem would be easier, for some measure of non-official assistance could then be looked for, and perhaps local associations formed, as I believe has been done elsewhere, but in a rayatwari Province very little of that sort of thing is possible. Neighbouring Rulers of States can no doubt be counted on to set an example, and jagirdars whose holdings are large enough to provide some measure of harbourage would in most cases be willing to co-operate to the best of their ability. For the rest, we shall probably have to wait till educated opinion—likely, one may hope, to be sympathetic but for the most part concentrated in the cities and towns—begins to influence the country-districts. By that time, it is to be feared, the herds of blackbuck and chinkara will have vanished from many places where they used to be a frequent and most pleasing sight.

However, the difficulty of enforcing measures is no argument against their being taken, if there is agreement about the object.

These species will not have been exterminated of course. Blackbuck when hard enough pressed take to the forests, and chinkara are always partly forest-dwellers, being found when undisturbed mostly on the border-line. In forest limits both can, like other species, find present sanctuary, and perhaps indulge the hope of returning some day to their old haunts. I said further back that the formation of larger sanctuaries than what the Forest Game laws afford, to be looked after by a special department, were out of the question in Bombay for financial reasons. I add here my definite opinion that for forest areas they are also unnecessary. The officers concerned have managed the laws for the protection of game in their own sphere of authority efficiently, and can be trusted to do so in the future, so long as their discretion is not unduly interfered with. The example of Africa, sometimes cited, is clearly no precedent for India—I need hardly set forth the reasons, for that would be to elucidate the obvious. The motor car is likely, it is true, to be an increasing embarrassment, but a special Game Department would be, as far as I can see, in no better case than the Forest staff for dealing with it. However, I am wandering into an academic discussion—a Game Department is anyhow not a practical proposition for Bombay.

If any rules and prohibitions on the lines of what I have suggested have been enacted already, or are in contemplation, I am sorry for my superfluousness, and can only plead that it is five years since I left India, and that I should have been glad if some one with up-to-date knowledge had been induced to write this article, instead of me. If not, I need only say that except on some such basis I can see no way of reducing even to a slight extent the super-abundance of fire-arm—and especially rifle—licences, or dealing with that infernal invention—how happy we were, game included, without it!—the motor car, and not even a distant hope of restoring to the country-side one of its most characteristic ornaments—blackbuck feeding confidently within view of the highway.

(*To be continued.*)

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